

R. P. SCHOOL

Alamdar Colony

Notes for
Class 10th



Subject: English

Pappachi's Moth

Thinking about the text: -
Sketch the characters of Pappachi and Mammachi.

Character sketch of Pappachi: -
Shri Benaan John Ipe (referred to as Pappachi which means grandfather) is a retired Entomologist. He is an unemotional and jealous person. He is very unfair and indifferent towards his family especially his wife, Mammachi. He is highly displeased by the success of his wife, which she gains because of her talent of pickle and jam making. He has the feeling of humiliation to see his wife in her prime when he is in his ripe age. When his son, Chacko stops him from beating his wife mercilessly, he feels it hurting his ego and abandons his wife. He does not talk to her or touch her throughout her life. He lacks the love and care of a husband and does not bear anything against his personality.
He dresses himself in a clean tailored three piece suit. He buys a Plymouth (car) from an Englishman and drives it very proudly to impress upon others about his Anglophillic nature. He uses a high class mahogany chair to sit but breaks it when Chacko stops him from harassing Mammachi. He discovers an unusual kind of moth and for six months, he struggles for its nomenclature. But to his disappointment, he retires and after twelve years, the Moth is considered unusual and new and is named after the acting director of Entomology.
He dies as a result of massive heart attack and his death is grieved most by his wife, Mammachi.

Character sketch of Mammachi: -
Soshamma (referred to as Mammachi) is the wife of the renowned Entomologist, Shri Benaan Ipe. She is an elderly lady but seventeen years younger than her husband, Pappachi. She is naturally inculcated with many talents. She is very good at making pickles and jams, which sell very quickly at a particular fair. She gets more orders and thus becomes employed particularly after her husband's retirement. She is very good at playing violin and takes some lessons of playing it during her stay at Vienna. She is a hard working lady and full of patience. She tolerates the beatings of her husband without a wink of complaint. These beatings are only stopped when her son, Chacko comes back from Oxford and stops his father from beating Mammachi. She is suffering from conical corneas and wears contact lenses to visualize things. She does not get the support of her husband throughout her life but still she keeps on supervising and managing everything alone and does not feel or let anyone else feel bad about her husband and never lets him down.

Q#2: 'I never want this to happen again', he told his father, 'Ever'. Who says it and why?
Ans: "I never want this to happen again, Ever." Chacko says this to his father, Pappachi.
He finds his father beating his mother mercilessly. So he stands against this barbaric behaviour and warns him not to repeat it.

Q#3: 'Ammu told the twins that Mammachi was crying more because she was used to him than she loved him.' In the light of the statement of Mammachi's daughter, comment on the relationship between Mammachi and Pappachi.
Ans: Mammachi and Pappachi's relationship does not have any element of care, love and understanding. Their relationship has jealousies, harassment and male supremacy in abundance. Mammachi can be considered as a tolerant lady and a silent worker. She is talented and patient. She loves and respects her husband to a great extent but she is more habitual of him. She is used to his abusive treatment and perhaps considers it her fate. On

the contrary, Pappachi is an unemotional person who is least bothered about the respect and sentiments of his family and particularly his wife, Mammachi. He is filled with envy to see

his wife progressing, which is a great flaw in their relationship. He is not helpful and cannot bear Mammachi's acclamation in the world of employment. So, we can say that their relationship is a commitment to stay together than to live and face every joy and sorrow together.

Q#4: How does Mammachi stand out as an independent and resilient woman in the text?

Ans: Mammachi proves to be a praiseworthy character of the story. She prepares delicious pickles and jams and becomes successful in this work. Soon, she receives more orders and thus becomes employed and independent. She is also a resilient lady because she adapts herself to the irritating and jealous nature of her husband. She tolerates the tyranny of her husband like a silent tolerant and never complains.

Q#5: Pick out the elements of irony in the lesson.

Ans: Irony is a figure of speech which consists of a statement that appears to be praise but is really condemnation.

The various elements of irony in the lesson are: -

i) He was seventeen years older than Mammachi and realized with a shock that he was an old man when his wife was still in her prime.

ii) When Chacko scolds him, Pappachi does not touch her for the rest of his life.

iii) He bought the skyblue Plymouth from an old Englishman in Munnar. The Plymouth was Pappachi's revenge.

iv) His moth was named after the Acting Director of the Department of Entomology a junior officer whom Pappachi had always disliked.

v) Mammachi was crying more because she was used to him than she loved him.

vi) Ammu said that human beings were creatures of habit, and it was amazing the kind of things they could get used to.

vii) In the evenings, when he knew visitors were expected, he would sit on the verandah and sew buttons that weren't missing onto his shirts.

viii) On his dressing table, next to the cologne and silver hair brush, he kept a picture of himself as a young man, with his hair slicked down.

Q#6: Identify instances of humour in the story.

Ans: The various instances of humour in the story are: -

i) Pappachi slouched around the compound in his immaculately tailored suit, weaving sullen circles around the mounds of red chillies and freshly powdered yellow turmeric.

ii) He became a familiar sight in Ayemenem, coasting importantly down the narrow road in his wide car, looking outwardly elegant but sweating freely inside his woolen suits.

iii) Pappachi's Moth was held responsible for his black moods and sudden bouts of temper.

The Merchant Of Venice

Q1 Why does Shylock hate Antonio?

Ans. Shylock is Antonio's enemy. Antonio is a kind man, but he always treats Shylock most unkindly. The reason for this is that Shylock is a Jew and Antonio is a Christian. During their times there was great ill-feeling between the Christians and the Jews. Besides, this Shylock lends money for profit and asks for high interest on his loans. Antonio, on the other hand, lends money out of kindness and asks for no interest on it. Moreover, Antonio insults Shylock in public. He calls him 'a dog' and spits upon him. Thus Shylock has a good reason to hate Antonio and he hates him with all his heart.

Q2 How does Antonio help Bassanio?

Ans. Antonio has a close friend, Bassanio. He is a handsome young man of noble birth, but he is in need of money. This is because Bassanio is in love with a lady of great beauty, wisdom and wealth. Her name is Portia, who lives in the city of Belmont. He wants to travel to Belmont to propose her but he needs money to make himself look as rich and important as her other suitors. So he asks Antonio to lend him three thousand ducats.

At the moment, Antonio does not have such a great sum because he has invested all his money in trade. Therefore, Antonio decides to borrow the sum from an old Jew called Shylock.

Antonio asks the Jew to lend him 3000 ducats upon any interest and obtains the money. Thus Antonio helps Bassanio and he sets out for Belmont with high hopes of winning the beautiful Portia as his wife.

Q3 How does Shylock feel when Antonio asks for some money? Why is he interested to pay the required sum?

Ans. Antonio's request for some money gives Shylock his chance of revenge. At first, Shylock pretends to hesitate about lending the money. He thinks for a while, making a cunning plan. He agrees to lend Antonio the sum of three thousand ducats pretending kindness to gain Antonio's love and trust. He tells Antonio that he would not take any interest for his money and would supply his wants. Shylock's real intention is to have his revenge. This is why he is interested to pay the required sum.

Q4 What condition does Shylock put forth if the debt is not paid in time?

Ans. Shylock's pretence of kindness greatly surprises Antonio. He agrees to lend Antonio the sum of three thousand ducats without any interest on a strange condition. He asks Antonio to come with him to a lawyer and there sign a bond, that if he does not repay the money by a certain day, he (Shylock) would forfeit a pound of flesh to be cut off from any part of his body that Shylock pleased.

Q5 How does Bassanio marry Portia?

Ans. Bassanio is desperately in need of money to court Portia. He wants to woo Portia, who he says has fallen in love with. He wants to travel to Belmont to propose her but he needs money to make himself look as rich and important as her other suitors. Bassanio asks Antonio for a loan in order to travel in style to Portia's estate. Antonio agrees but is unable to make the loan himself because his own money is invested in a number of trade ships that are still at sea. Thus, Antonio borrows money from Shylock and with the money, taken Basanio sets sail for Belmont and arrives at Portia's estate. They declare their love for one another. Thus Bassanio succeeds in winning the hand of Portia and asks Portia to marry him.

Q6 Why is the case brought before the Duke of Venice?

Ans. The case is brought before the Duke of Venice because Shylock ignores the many pleas to spare Antonio's life and suits against Antonio claiming the penalty of a pound of flesh. Thus a trial is called to decide the matter.

Q7 Who is disguised as the learned counsellor (Doctor Balthasar)? Why has he come to the court of Venice?

Ans. Portia is disguised as the learned counsellor. Portia enters the high court of justice and presents a letter from Bellario, in which the learned counsellor writes to the Duke that he would have come himself to plead for Antonio but he is prevented by sickness and requests that the learned young Doctor, Balthasar (Portia) might be permitted to plead in his stead. Thus, the learned counsellor (Portia) has come to plead for Antonio in order to save his life.

Q8 How did the counsellor start his argument and how was he able to get the judgement in Antonio's favour?

Ans. Portia disguised as a young man of law began by arguing in favour of Shylock, by declaring that Shylock indeed had a right to Antonio's pound of flesh. But in a moving speech the counsellor asked Shylock to show mercy, but Shylock remained inflexible and insisted the pound of flesh was rightfully his, according to the bond. Portia examined the contract and finding it legally binding, declared that Shylock was entitled to Antonio's flesh. Shylock ecstatically praised her wisdom but as he was on the verge of collecting his due, Portia reminded him that he must do so without causing Antonio to bleed, as the bond didn't entitle him to any blood. Trapped by this logic, Shylock hastily agreed to take Bassanio's money instead, but Portia insisted Shylock to take his bond as written, or nothing at all. Portia informed Shylock that he was guilty of conspiring against the life of a Ventian citizen and he must turn over half of his property to the state and the other half to Antonio. Finally, the Duke spared Shylock's life and took a fine instead of Shylock's property. Antonio also gave his half of Shylock's wealth to Shylock's daughter who had married a Christian against his father's wishes. Thus the counsellor won the case and was able to get the judgement in Antonio's favour.

Q9 How does Portia get back her ring?

Ans. After winning the case for Antonio, Bassanio thanks Portia, though he does not see through her disguise, and offers her to accept a gift. Portia declines the gift and says that having delivered Antonio from Shylock's clutches is payment enough. But Bassanio insists and she eventually agrees and asks Bassanio for the ring on his finger. Bassanio finds himself in a difficult situation because he had promised his wife that he would never part with the ring. He offers to find the most valuable ring in Venice, but Portia remains firm, and demands the trifle or nothing. When Bassanio admits that the ring is a gift from his wife, who made him promise never to part with it, Portia pretends to be angry.

Antonio urges Bassanio to let Portia have the ring, saying that he should value Antonio's love and the gentleman's (Portia) worth more than his wife's orders. Thus poor Bassanio has to agree and very unwillingly gives away the ring to Portia.

Q10 Describe the themes of the play.

Ans. The Merchant of Venice is a tragic comedy alleged to have been written between 1596 and 1598 by William Shakespeare. The main themes of this play are 'love and hatred' and 'justice and Mercy'. They aid us to learn about the characters and comprehend why they act as they do.

The play tells us that love is more important than money, mercy is preferable to revenge and love lasts forever. We notice that the most notable relationship is the one between Antonio and Bassanio. Antonio loves Bassanio enough to give his life for him- indeed it seems that Bassanio is one of his only reasons for living. Moreover, there is love between Bassanio and Portia. On the contrary, the differences between Antonio and Shylock appear to be that Antonio values human relationship over business ones, whereas Shylock is only interested in money. Antonio lends money free of interest and puts himself at risk for those he loves, where as Shylock agonizes over the loss of his money, suggesting that his greed overweighs his love. In between religious intolerance and personal revenge the play seems devoid of mercy. Against all the odds, Portia does manage to bring about some mercy. She succeeds in transmitting the proceedings away from violence and towards forgiveness. Therefore, we can say that love, hatred and mercy are the dominant themes of the play.

The Servant (S.T. Semyonov)

Thinking About The Text:-

Q#1 Why had Gerasim been going about in vain?

Ans. Geras im had been going about in vain because he was rendered jobless. He was searching for a job at a time when it was difficult to find one. It was Christmas Eve and everyone stuck to the pity job in the expectation of a present.

Q#2 Where had he been working? Why did he return to his village?

Ans. He had been working as an employee of a merchant. Before that he had worked in a brewery and as a lower servant.

He had been called to his village for his recruitment in military services, (i.e. he was conscripted). Unfortunately, he was not selected and thus he had to go without work for weeks together.

Q#3 What did the coachman tell Gerasim when he narrated his story?

Ans. When Gerasim narrated his story, the coachman condemned him for working inefficiently. He told him that the young people like him were unsuccessful to impress their masters and when they were replaced, there was no chance for them to join back because of the bad impression.

Q#4 How did the coachman persuade his master to employ Gerasim?

Ans. The coachman persuaded his master to employ Gerasim by suggesting him to expel the janitor who had grown old and was unable to carry out the assigned jobs efficiently. He motivated him to dismiss the old servant who had worked for him for fifteen years. He assured his master that the old janitor and his wife had earned enough money to lead their future life comfortably. His master trusted him more than anyone else and thus agreed with his suggestion of replacing old janitor with Gerasim.

Q#5 Why was the master reluctant to disengage the old servant?

Ans. The old servant, Policarpych had been a loyal and trustworthy servant of his master for fifteen long years. He had served him a lot. The old man had dedicated his prime, energetic and youthful period of his life in the service of his master. So the master was reluctant to disengage him. He felt it unjust to dismiss him in his ripe age when he should be paid for his life long service. But the coachman poisoned his ears and provoked him to disengage the poor, old servant.

Q#6 What did Gerasim hear while crossing the yard?

Ans. While crossing the yard, Gerasim heard the old servant, Polikarpych (whom he was supposed to replace) complaining against the coachman. They seemed to be pained at the thanklessness of their master. They also talked about the treacherous and deceptive nature of the coachman. His wife also continued abusing the coachman and the old couple was worried about their survival in future without a job.

Q#7 What did the old couple think about the master?

Ans. The old couple was very annoyed and disheartened by their master's decision. The old servant's wife considered her master mean and thankless. She believed that their master exploited them when they were energetic and strong, but when they became weak, he preferred to expel them rather than supporting them in their old age. However, the old servant, Policarpych was of the opinion that his master was not at fault but his ears were being poisoned by the coachman.

Q#8 What was the effect of the old couple's conversation on Gerasim?

Ans. The old couple's conversation pinched him and he became heart-sore. He was deeply hurt by their talks and decided to look for other job than to deprive the old man from his job which he needed badly.

Q#9 How does the story reflect the humility of Gerasim?

Ans. The story is a subtle reflection of humility of Gerasim because he refused to work in place of Polikarpych. He did not tolerate to render an old man jobless in order to employ himself. It indicates that he was a man of heart who preferred to leave his job but did not work in place of an old and faithful servant.

Dusk

Q#1 What was the atmosphere at the Hyde Park?

Ans. It was around half past six in the evening of the month of March. Norman Gortsby the speaker was enjoying twilight of the dusk. He was sitting in Hyde Park and was deliberating on the people strolling around in the dusk. The park was scantily occupied and the pedestrian movements were less on the footpath. There were many people moving silently and gloomily in half light of the dusk. Some were sitting on the benches and chairs in the park. They could be scarcely distinguished due to the fall of dusk on the park. The overall atmosphere of the park was very depressing and more appropriately dusky.

Q#2 Do the atmosphere and mood at the park justify the title of the story.

Ans. The story has been described in the dusk time. It is that time of the day when the light has almost gone, but it is not yet completely dark. It is half past six and the dusk has fallen heavily on the scene. The atmosphere alone is not dark, gloomy and dusky; the people who have come to the park at this time of the day also seem to be depressed and defeated by the struggles of life. It appears as if the people who have come to the park in the dusk have given up the hope of success and vitality in their life. These people want to remain unnoticed from other people of the world and they want to reflect and meditate about their defeated life in spite of the unparalleled efforts to succeed it. The author has used the term 'bat fashion', to describe these people because they hide their identity from others due to the fear of criticism and accusation and thus come out in the dusk to soothe their discontented feelings towards their life.

Q#3 Draw a profile of the person who sat near Gortsby on the bench.

Ans. It was an elderly gentleman who sat first by the side of Gortsby on the bench at the Hyde Park. The old person was in tattered clothes, looking shabby and his face had the expressions of loneliness, helplessness and expressed hidden anger, as if a lifeless stone was sitting beside Gortsby. He seemed to be a perfect picture of a person with self respect. He did not bow or seek help from anybody. He seemed to be uncared probably because he was in the dusk of his life.

Q#4 What according to Gortsby was the weak point of the young man's story?

Ans. The young man who sat beside Gortsby was a newcomer in the city. He had gone out of the hotel to buy soap because he disliked hotel soaps. He further said that he had been walking leisurely in search of the soap and had not kept any record of the distance he had traveled from the hotel. After buying the soap, he had entered a pub to have a drink. He said that when he had intended to return to his hotel, he had realized that he neither remembered the way nor the name and address of the hotel he was staying in Gortsby believed this story of the young man because he himself had faced a similar fate along with a friend in a foreign capital. He did not completely discard it but in order to convince himself about the reality of his story, he asked the young man to produce the soap which he had bought. To his surprise, the young man was unable to produce the soap and he pretended to have lost it. Gortsby identified it as a weak point of his story and considered it an intentional creation of the youngster to fool others and to earn money out of sympathy.

Q#5 While walking back to his seat in the park, what did Gortsby see?

Ans. While walking back to his seat in the park, Gortsby saw the same old man who had been sitting beside him earlier. He saw the old man poking and peering under the bench as if looking for

something. He asked the old man if he had lost anything. The old man replied that he had lost the soap which he had bought.

Q#6 How did Norman Gortsby feel when he realized he had been fooled?

Ans Gortsby was very clever and alert. The young man had, no doubt tried to fool him, but he had not been fooled. The story narrated by the young man did not convince him and he quickly inferred it to be an emotional drama. He could even decipher various weak points in the young man's story but still the youth succeeded in befooling him. He convinced him in a very impressive and believable manner. Gortsby was very emotional when he saw the soap under the bench and quickly condemned himself for suspecting the youth. He went from pillar to the post to find the young man and give him the cake of soap. He also gave him a sovereign as a mark of gratitude and sympathy. And finally when he came to know of the real thing, he could do nothing but beat his head and laugh at himself.

Q#7 What did Gortsby imagine about the people who visited the Hyde Park?

Ans Gortsby had a different perception about the people who visited the Hyde Park in the evening. He believed that the people who had come to the park at that time of the day had reached the dusk of their life. They were the people who had struggled and lost in life. Their hopes were dead. It was reflected from their shabby clothes, bowed shoulders, weathered faces and unhappy eyes. That is why they came to the park at dusk. Moreover, the silence and the gloom of the atmosphere harmonized with their feelings. He also compared them with bats that steal away from daylight and appear only in the dark. These people also avoided meeting the people due to their defeated life.

Q#8 Bring out the elements of irony in the story.

Ans Gortsby is the pivotal character in the story 'Dusk'. A young man tries to fool him. Gortsby tries to be clever and finds the flaws in the young man's creative story. He proves to be a man of wits and does not let the young man trick him or fool him. But later on, due to some strange situations, he is easily deceived and tricked by the young man. It happens as a result of irony of the situation. The elderly man loses his cake of soap. He loses it on the same bench where Gortsby was sitting. His seat is soon occupied by a young man. He coincidently makes up his story round the cake of soap. But Gortsby doesn't believe him and later he goes running to find the young man and gives him the soap that never was his. All these are the elements of irony in the story.

Q#9 What is juxtaposition? Has Saki been able to juxtapose humour and pathos in 'dusk'?

Ans Juxtaposition means putting opposite things together to show the contrast. In this story 'Dusk', Saki has very beautifully and subtlety juxtaposed humour and pathos.

There is pathos in the description of people whose hopes are dead and who are losers i.e. who have fallen fortunes. There is pathos in the description of the elderly gentleman who is uncared. And the juxtaposition can be seen when the young man uses the same element i.e. soap in his story. We smile to ourselves when the weak point in the young man's story is picked. And then we burst into laughter when the elderly gentleman says, "Yes, Sir I have lost a cake of soap." There is both humour and pathos in the way Gortsby gets fooled.

Out Of Business

Thinking about the text:-

Q#1 What was Rama Rao's business? How did it collapse?

Ans. Rama Rao worked as a Malgudi agent of a gramophone company. He had also invested some amount in the company, which he had inherited from his ancestors. Unfortunately the company collapsed as a result of the Bombay financier's death.

Q#2 What effect did it have on him and his family?

Ans. The collapse of Rama Rao's business was a catastrophe for him. He suddenly found himself in terrible financial crisis. His wife sent away the cook and the servant, withdrew their children from a reputed school to a fee-free school. They let their bungalow out and resided in a small house in a market place. Rama Rao started looking for a job in order to earn money.

Q#3 Which is 'stock' referred in line23?

Ans. 'Stock' refers to the few gramophones left with Rama Rao to be supplied to Malgudi.

Q#4 Why did Rama Rao worry less about his familyafter he came across 'The Captain'?

Ans. After coming across 'The Captain', Rama Rao's whole attention diverted to the crossword puzzle of the said magazine to earn more money in less time. Now he thought more about solving the puzzle in the magazine than the problems of his family. He continued asking for money from his wife and became insensitive about the needs of his family and worsened the conditions of his family. He preferred to solve puzzles given in 'The Captain' to earn more and more money rather than thinking about any other means of livelihood.

Q#5 Why did Rama Rao decide to send in at least four entries for the "special offer crossword competition"?

Ans. Rama Rao decided to send in at least four entries for the 'special offer crossword competition,' because he had become desperate to earn a good sum of money i.e. Eight Thousand Rupees, in a very easy and short way. He asked his wife for five rupees to send in four entries so that he gets the prize anyhow. No doubt, he troubled and grieved his wife and children but left no stone unturned to gain the effortless sum from the crossword puzzle.

Q#6 Whydid Rama Rao plan to go to Madras?

Ans. Rama Rao planned to go to Madras to find some lucrative job for himself.

Q#7 What made Rama Rao believe that God had shown him mercy?

Ans. Rama Rao believed that God had shown mercy on him because he was lucky that he got a chance to amend his error. He had got an opportunity to work hard and earn for his family, after being saved from suicide attempt. Rama Rao had repented on his mistake and could start his life afresh with his family only because of God's mercy.

Q#8 How did Rama alternate between hope and despair?

Ans. Rama Rao's life had become like a pendulum which oscillated between hope and despair. This alternation had been brought about by Rama Rao's follies. He was driven by the greed of gaining more and more money easily and by short cut method. He lost his self respect and thinking capacity because of this hope-despair transmission. He hoped that by solving those useless puzzles, he could earn money. Every time he failed in solving them, he again overwhelmed himself with despair and disappointment. Then, after recovering from this hopelessness, he would again fix his eyes and hope on the next week's puzzle. This alternation ruined his life.

Snowdrop

Central Idea:- Life is full of struggles and hardships. The person who tackles these hindrances with determination and courage is said to be brave and successful. Nature also uses various processes to teach the humans the lesson of success by determination and positive approach.

Summary:- The poem entitled 'Snowdrop' has been authored by 'Edward James Hughes' or 'Ted Hughes' (pen-name). The poet presents the harsh and cruel image of nature unlike other poets who use nature to depict beauty and glamour. The poet pictures the life of different aerial and terrestrial animals which are affected by the severe winter. Finally, he talks about a flower called Snowdrop which blooms in harsh winter. He admires the flower, of Snowdrop for sprouting through the frosty earth's surface.

In the commencing stanza, the poet says that the globe has shrunk because of the extreme cold. He says that cold has curtailed the movement of active and brisk creatures like mouse, which seem to be dull and inactive. Further, the poet says that the crows, which are free to fly anywhere, are also restricted by the cold weather and the weasels also remain dormant as if they are moulded into the statues of brass. Even if these creatures try to move out in order to find their prey, it appears as if days were converted into nights because everything seems to be dozing and lifeless. Moreover, they try to return to their places quickly due to the threat of death because of chilly winter and, thus, this seems to be worried and senseless.

In the next stanza, the poet turns his attention towards the little, gloomy flower, Snowdrop which blooms in such a harsh weather and cuts its way open through the frosty earth. It blooms in a beautiful way like the stars of winter season which shine without any consideration of cold and hot season. The snowdrop blooms with its drooping flowers which make a feel that its small, pale head is made of metal. Despite of its heavy flowers and severe winter, it achieves its goal and blooms.

Thinking About The Poem:-

Q#1 How has nature shrunk the globe?

Ans. The nature has shrunk the globe by enclosing it in a blanket of severe and harsh winter. It has restricted all the creatures to their dwelling places and they feel the earth to be small and limited for them.

Q#2 What has dulled the mouse's heart?

Ans. The active mouse's heart has been dulled and deactivated by the chilly, harsh winter.

Q#3 What sufferings do the animals undergo in the poem?

Ans. The animals suffer a lot due to the winter season. Their movements are curtailed; everything appears to be dull, gloomy and dark; even the days seem similar to nights and it becomes difficult for them to hunt for prey. Overall winter creates havoc in the life of all the creatures.

Q#4 Write a short note of 50 – 100 words on Hughes' view of nature.

Ans. Ted Hughes is a nature lover undoubtedly because he captures the beauty of nature apparently in a negative way. He is pessimistic towards nature. He portrays the harsh winter and its impact on the life of aerial, arboreal and terrestrial animals. He feels that most of the creatures die or perish in this season and many animals decrease their daily activities and movements because of the threat of death due to chilly winter.

Finally, he describes a small flower, Snowdrop which depicts his loving feelings towards nature. He is highly impressed with the little drooping flower which withstands the terrible weather to bloom. The poet compares the flower to the heavenly stars which are also determined to shine regardless of the harsh winter conditions.

Q#5 "Her pale head heavy as metal" Explain.

Ans. The snowdrop is a small drooping flower which erupts out of the earth's surface and bends down as if its dull head is made of hard metal.

My Mother At Sixty Six

Central Idea: -

Aging is an important phase of human life. A person enters his childhood, experiences youth when he is full of energy and dreams to have luxury of life. Finally, he approaches his old age and encounters death. Relationship between people becomes stronger at every aspect of life and they can't bear separation due to aging.

Summary:-

The poem entitled "My Mother at sixty six" has been authored by "Kamala Das". The poetess portrays a sensational separation of a mother and a daughter. She has been able to capture almost all the emotions which a daughter is filled with, on bidding farewell to her beloved mother. In the commencing verses, the poetess says that one Friday while traveling to Cochin Airport from her parent's home, she suddenly has a look at her mother sitting beside her in the car. The look of her mother's face makes her dumbfounded and she painfully concludes that her mother has attained a ripe age of sixty six, and is thus approaching her death. She finds her mother gloomy, worn out and aged. She is often dozing and remains unconscious about herself like a dead body because of the increasing age. This thought haunts her and she tries to put it off by looking out of the car window. There she finds young, blossoming trees passing by the fast moving car and merry children playing gaily and energetically. The poetess uses a device of contrast to depict that human being experiences childhood when he is carefree and blithe; then youth, when he is full of dreams and wishes and ultimately old age when he becomes gloomy, inactive and dozing. The poetess further says that she enters the airport and passes through the security check up for frisking and again gazes at her mother. Her mother seems pale and charm-less to her like the dull moon in the late winter season. At that time, she feels a pain which is usually felt by a child due to the fear of separation from his mother. She seems to be bound to leave her mother in order to earn her livelihood or some other reason. Ultimately, she bids good bye to her mother with a hope to see her again. She keeps on smiling continuously in order to conceal her emotions and to give her mother hope to see her daughter again.

Thinking About The Poem:-

Q#1 How does the poet describe her mother in the poem?

Ans. The poet describes her mother as an aged lady who has become gloomy, inactive and worn out. She is often dozing and remains unconscious about herself like a dead body.

Q#2 Why does the poet look outside? What activities does the poet see outside the car window?

Ans. The poet concludes and believes that her mother is nearing death. The thought of the numbered days of her mother's life makes her anxious‹ and in order to divert her attention from her mother she looks outside. The poet sees young trees in full bloom while traveling in a car. She also finds little children coming out of their homes in a very active, energetic and lively way.

Q#3 Why are young trees described as sprinting?

Ans. Young trees are described as sprinting with respect to the car. In deeper meaning, by sprinting young trees, the poet means that the youth passes out of life of humans quickly and a person enters his old age where he nears his death.

Q#4 Why is the mother compared to the late winter's moon?

Ans. The mother is compared to the late winter's moon because like the moon of winter season the poet's mother is also dull, grayish, pale and her strength is diminishing and waning.

Q#5 What childhood fears do you think the poet is referring to in the poem 'My Mother at Sixty Six'?

Ans. The childhood fears that the poet is referring to are the anxious feelings of losing one's mother. The poet feels uneasy and unprotected with the thought of losing her mother. She does not expect to see her mother again on her return. So she shows a childish unwillingness to leave her mother.

Q#6 What does Kamala Das do after the security check up? What does she notice?

Ans. After the security check up, the poet stands a few yards away from her mother and gazes at her mother. She notices the declining age and finds her pale and worn out than ever before.

Q#7 "but all I said was see you Amma; all I did was smile and smile and smile….."

a) What does the poet actually feel at this moment?

Ans. The poet actually feels very depressed and disheartened at the sight of her aging mother.

b) **Why did the poet say 'see you soon Amma'? What does the poet actually mean by 'smile and smile and smile….'? What kind of smile is it?**

Ans. The poet said, 'See you soon Amma' in order to give her mother moral support and encouragement. She said so to give her mother hope to see her daughter again.

By 'smile and smile and smile…..' she means to make herself and her mother hopeful to see each other again.

It is actually a painful smile. The poet tries to conceal the swelling emotions by smiling. By using this poetic device of repetition, the poet has made the poetic language rich by depicting many hidden emotions through 'smile'.

Q#8 **'Driving from my parent's home to Cochin last Friday morning. I saw my mother, beside me, doze, open mouthed, her face ashen like that of a corpse and realize with pain that she was as old as she looked**

a) **Where was the poet driving to? Who was sitting beside her?**

Ans. The poet was driving to Cochin. The poet's mother was sitting beside her.

b) **What did the poet notice about the mother?**

Ans. She noticed that her mother was weak, pale and unconscious like a dead body.

c) **Why did the mother's face look like that of a corpse?**

Ans. The mother's face looked like a corpse because it had turned pale, grey and was open mouthed due to old age.

Q#9 **Discuss mother- daughter relationship as described in the poem.**

Ans. Mother- daughter relationship as described in the poem is very sensitive and full of love, care and emotions. Mother has a deep emotional link to her children and does not want them to be away. In particular, when the mother approaches her old age, she becomes more concerned and worried about her children. Daughter also tends to bear a specific kind of emotional link to her mother. She tries to remain close to her mother and feels very bad and worried when separated from her. In this poem, the mother does not want her daughter to leave her; similarly the daughter gives a mysterious and indefinable smile which is to show unwillingness and anxiety of leaving her mother.

Q#10 **'My Mother at sixty six' is an emotional account of the poet towards the numbered days of her mother. Discuss.**

Ans. 'My Mother at sixty six' is an emotional account of the poet towards the limited days of her mother. She feels very sad and depressed on seeing her old, grey, wrinkled and dull face. She tries her best to divert her thought but remains unsuccessful and this thought haunts her mind every now and then. Till the end of the poem, she feels very sad and disappointed about the declining age of her mother. She is unable to express her fears and emotions to her mother with the thought of disheartening her. She bids goodbye to her mother by just smiling in order to hide her hurt feelings and encourage her mother.

Learning About The Literacy Devices:

Q#1 **The poet compares her mother to many things. Pick out two similes which reinforce this comparison**.

Ans. The two similes are: - "Her face ashen like that of a corpse."

"I looked again at her wan, pale as a late winter's moon"

Q#1 **What image does the poet use to describe death in the poem?**

Ans. The poet uses the image "corpse" to describe death in the poem.

Q#3 **Cite an example of one device of contrast that the poet uses in the poem.**

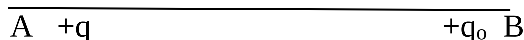
Ans. The device of contrast that the poet uses in the poem is old age of her mother and the young trees and children playing merrily. The poet compares the energy, vitality and jubilance of childhood and youth to old age.

Q#4 **Smile and smile and smile…..is a poetic device, what is it called?**

Ans. 'Smile and smile and smile…..' is a poetic device called repetition. It is used to make a poem impressive using less words. A particular word is repeated to make the poem thought provoking.

Q#1 What is potential difference?

Ans. When a small + ve test charge + q_o is placed in an electric field due to another charge +q, then it will experience an electric repulsive force F due to +q. So, work has to be done on the +ve test charge $+q_o$ to move it from B to A against the force of repulsion.



"The ratio of the work in taking a test charge + q_o from one point o another in an electric field is called the potential difference between those points.

If W be the work done test charge from B to A, then potential difference between A and B is given by

$$W = VA - VB$$

Potential difference is a scalar quantity.

Unit of P.D:- The P. D. between two points is said to be 1 volt if 1 joule of work is done in moving a test charge of 1 coulomb from one point to another in an electric field.

Q#3. What is electrostatic potential?

Ans. When a small +ve test charge $+q_o$ is placed in the electric field due to another charge +q, then it will experience an electric repulsive force F due to +q. So work has to be done in the +ve test charge $+q_o$ to move it against this force of repulsion.



The electrostatic potential or potential at a point (say A) in an electric field is the ratio of the work done in bringing a test charge $+q_o$ from infinity to that point.

$$\therefore \text{Potential at A} = V_A = \frac{W}{q_o}$$

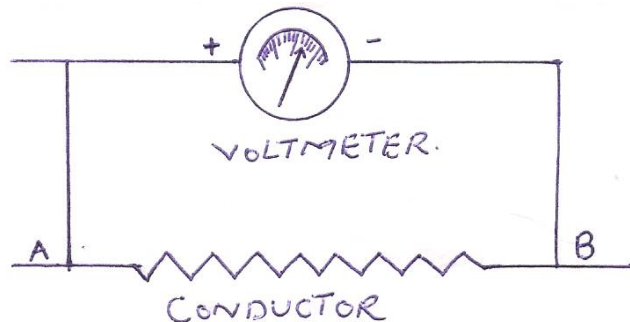
Unit of Potential: - Potential is denoted by the symbol V and its unit is volt the electrostatic potential at any point is said to be 1 volt, if 1 joule of work is done in bringing a test charge of 1C from infinity to that point in an electric field

$$\text{Thus 1 volt} = \frac{\text{1 joule}}{\text{1 Coulomb}}$$

Like work, potential is a scalar quantity.

$$\text{Thus 1 volt} = \frac{1\ \text{Joule}}{1\ \text{Coulomb}}$$

The P.D is measured by voltmeter. The voltmeter is connected in parallel across the points where the P.D is to be measured.



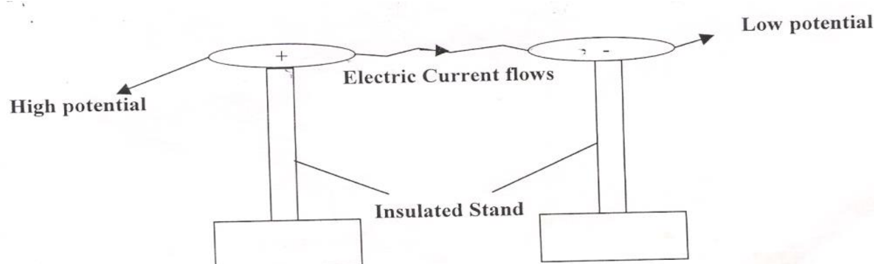
<u>Problem:</u> How much work is done in moving a charge of 10C from a point at 110V to 130V?

Sol.	Potential difference	=	130 – 110 = 20V
	Q	=	10C
	Now V = W / Q or W =		VQ
	Or W = 20 × 10	=	200 j
	Thus work done W	=	200 joules.

Q#4 Define electric current. Give its units.

Ans. Suppose we have two metallic spheres at different potentials. In general the charges will not be able to move freely from one sphere to the other in spite of potential difference. This is so because the charges will not be able to leave the surface of the spheres. However, if they are connected by a conducting wire flow of charge takes place from higher potential to lower

potential. This flow continues until there is no longer a potential difference. Thus the current stops when the P.D between the two ends of the wire is zero.



"The flow of charge in a definite direction constitutes the electric current and the time rate of flow of charge through any cross section of a conductor is the measure of current i.e., If q be the charge flow through a given conductor in time t second, then current I is given by

$$I = \frac{\text{Total charge flowing}}{\text{Time taken}} = \frac{q}{t}$$

If the rate of flow of charge is constant with time, the current is called steady current. However, if the rate of flow of charge does remain constant, it is called varying current.

Unit of Current: -S.I. unit of current is ampere. It is denoted by A, where 1 ampere, $1A = \frac{1\ \text{Coulomb}}{1\ \text{second}}$

1 A = 1C / 1S

Thus the current through a wire is said to be one ampere, if one coulomb of charge flows through the wire in one second.

Since 1 electron carries charge = 1.6×10^{-19}C.

Hence for 1 C of charge = $\frac{1}{1.6 \times 10^{-19}} = 6.25 \times 10^{18}$ electrons should flow

Thus 1 ampere = 6.25×10^{18}e s enter at one end and an equal no. of other e s leave at the other end.

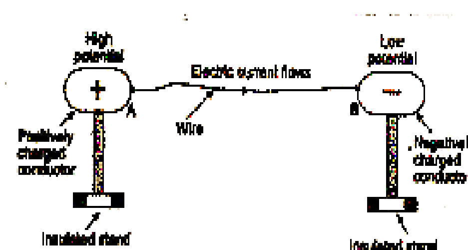
Sometimes smaller units of current are used 1 milli-ampere = 1 / 1000 amperes

Or 1 mA = 10^{-3} A.

and 1 micro ampere(μA) = 10^{-6} A

Current is measured by an instrument called ammeter. The ammeter is connected in series with circuit in which the current is to be measured. Ammeter should have every low resistance so that it may not change the value of the current flowing in the circuit.

Direction of electric Current: - The conventional current flows from positively charged body to negatively charged body and the positively charged body is at higher potential and negatively charged body is at lower potential. But in metallic conductors the entire transfer of charge is only due to the motion of electrons. This direction of electronic current (real current) flows from negatively charged body to the positively charged body and the positively charged body is at lower potential and negatively charged body is at higher potential. Thus the conventional direction of the current is opposite to the direction of flow of negative charge.



Problem: **A charge of 200C flows through a conductor in 6min and 40s. Find the magnitude of current.**

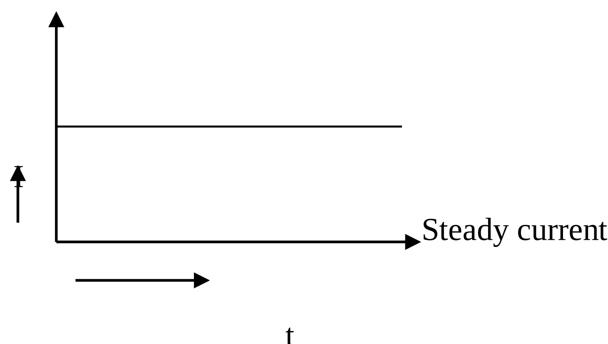
Sol. Charge (q) = 200C

time (t) = 6 min + 40s = 400s

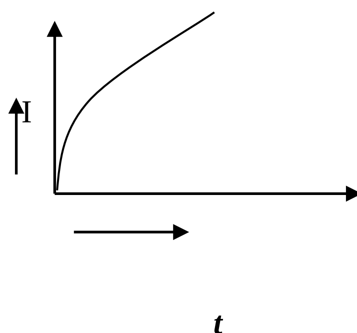
Current (I) = q / t = 200 / 400 = 0.5 A.

Types of current.

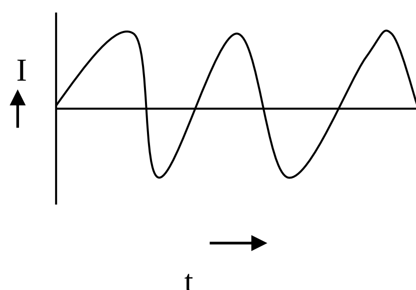
1. **Steady Current: -**The current whose magnitude does not change with time is called steady current. A current from a cell or a battery is steady current. The graph of steady current is shown below



2. **Varying Current: -** The current whose magnitude changes with time but not direction is called varying current i.e., current obtained from a D.C. dynamo the curve shows below represents a varying current.



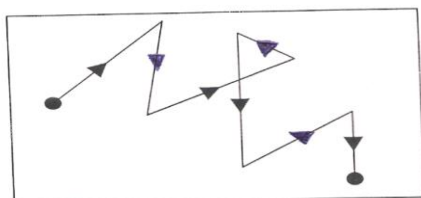
3. **Alternative Current: -** The current whose magnitude changes continuously with time and direction periodically is called alternating current e.g., current obtained from A.C dynamo. Such a current is represented by a sin or cosine curve.



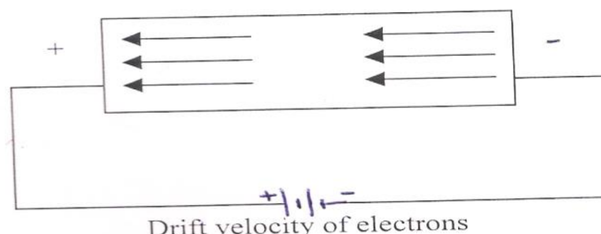
Q#5 Discuss the flow of current in a metallic conductor.

Ans. In a metallic conductors, the electrons of a valence shell (of the order 10^{23} in 1 mole) of the atoms gets easily removed and hence a sea of mobile electron are formed in the metal. These electrons move with a high speed of 10^6 m/s even at room temperature but the electrons move in an irregular fashion or zig-zag paths like the molecules of the gas contained in a container and hence the average velocity of the electrons is zero i.e., no current flows in the conductor.

However, if the metallic conductor be now placed across a potential source (cell or battery) then all the electrons of the conductor get drifted towards the +ve end of the conductor and thus constitutes the electric current in the wire.



Zig Zag path of electrons



Drift velocity of electrons

Q#6 Define resistance. What are the laws of electrical resistance?

Ans. Resistance of a conductor is defined as the ratio of potential difference applied to the ends of conductor to the current flowing through it.

Mathematically $R = V / I$

The resistance of a conductor implies the obstruction or friction which the conductor offers to the flow of electrons through it.

Unit of Resistance: S. I. unit of resistance is Ohm. It is denoted by Ω

$$1 \text{ Ohm } (\Omega) = \frac{1 \text{ volt}}{1 \text{ amp.}} = \frac{1\text{ V}}{1\text{A}}$$

The resistance of a conductor is said to be one Ohm, if one ampere of current flows through it, when a potential difference of one volt is applied to it.

Factors on which electrical Resistance depends:-

1. Electrical resistance is α to the length of conducting wire i.e., more the length of wire more is the electrical resistance.
2. Electrical resistance is inversely proportional to the area of cross section of wire.
3. Electrical resistance depends upon the nature of wire e.g., copper, aluminium or silver have very small resistance while as lead, platinum, michrome, manganim, tungsten etc. offer larger resistance. Electrical resistance depends upon the temperature. The resistance of metals increases with rise in temperature.**#7 State and explain Ohm's law. How will you verify it experimentally?**

Ans. In 1826, German Scientist George Simon Ohm expressed the relation between the current and the potential difference flowing through the conductor, which is called Ohm's law.

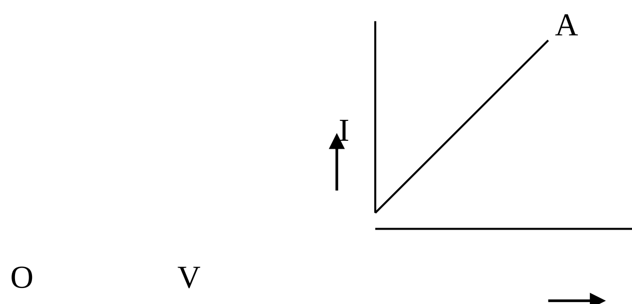
According to this law, "if there is no change in the physical state of a conductor such as temperature, mechanical strain etc. then the current (I) flowing through a conductor is $\propto$ to the P.D, across its ends i.e., mathematically

$I \propto V$ or $V \propto I$ or $V = RI$ or $V / I = R =$ constant, where R is constant of proportionality and is called resistance of the conductor.

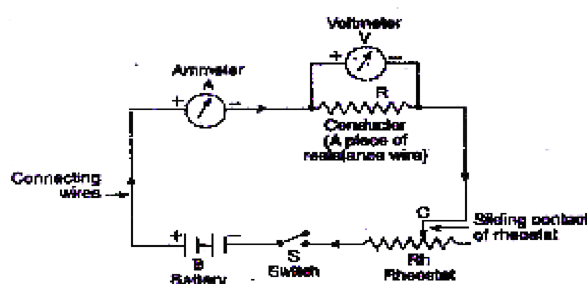
The unit of resistance is called Ohm and is expressed by the Greek alphabet Ω. If the P. D. across the ends of a conductor is 1 volt and the current flowing through the conductor is 1 amp, then the resistance is 1 Ohm.

1 Ohm or 1 Ω = 1 V / 1 A

The resistance depends upon the length, area and the nature of the material of the conductor. The graph between P. D. and the current through a conductor is a straight line OA. Ohm's law is valid only for metallic conductors at a constant temperature and for steady currents. It does not hold for semiconductors and gases.



Experimental Verification of Ohm's Law: - To verify Ohm's law, an electrical circuit is maintained as shown in the diagram



In this circuit a battery B, a key k, an ammeter A and a rheostat are connected in series. A voltmeter V is connected in parallel across the two ends of the resistor.

When the key is closed, the current flows in the circuit as shown by the ammeter. The potential difference is measured by the voltmeter. Let it be V volt. Similarly note down the value of current in the ammeter. Let it be I amperes. If R Ohm's is the value of resistance of the resistor then R = V / I Ohm's. Go on changing the value of the current by sliding rheostat, and the corresponding values of the P. D. are recorded. Each time find the value of R, it is found to be constant. This verifies Ohm's law.

Q#8 What are Ohmic and Non-Ohmic circuits?

Ans. Ohmic Circuit or a Linear Circuit:- is one in which P. D. is directly proportional to current. A circuit containing a resistor is an Ohmic circuit. The resistance of Ohmic circuit is a constant and does not change with voltage.

Non-Ohmic Circuit: - is one in which P. D. is not proportional to the current. Rectifiers discharge tubes and vacuum tubes are non-Ohmic circuits.

Q#9 What are Conductors, Resistors and Insulators?

Ans. **Conductors: -** The substance which has low electric resistance to the flow of current are called conductors. Silver, copper, aluminium etc. are conductors.

Resistors: - The substance with comparatively higher resistances is called resistors. Nichrome, manganin, eureka etc are resistors.

Insulators: - The substances which have extremely high resistance are called insulators. Wood, rubber etc are called insulators.

Q#10 Birds sit on 11,000v wire but are not killed but when a man touches220v wire he dies, why?

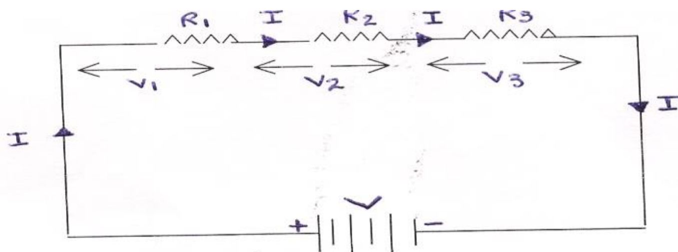
Ans. The death is caused due to current flowing on the body. When a bird is perching on high power line, it is at a potential of 11,000v. The current flows due to potential difference and not due to potential. A man dies on touching a 220v wire because his body is in contact with the earth at 0 potential. It is the potential difference and not potential makes the current flow in the body.

Q#11 Find the expression for the combination of resistances when they are connected in series and in parallel.

Ans. In many practical applications two or more resistances are required to be combined in a number of ways to increase or decrease the combined resistance.

Resistances are combined in two ways: - (1) In series (2) In parallel

Resistances connected in series: - Resistors are said to be in series if they are joined end to end so that the same current flows through each resistance when some P. D. is applied across the combination.



In figure three resistances R_1, R_2 and R_3 are connected in series, let the current passing through them be I. If V_1, V_2 and V_3 are the potential differences across R_1, R_2 and R_3, then according to Ohm's law

$V_1 = IR_1$, $V_2 = IR_2$ and $V_3 = IR_3$. If the P. D. between A and O is V then

$$V = V_1 + V_2 + V_3$$

$$\text{Or } V = IR_1 + IR_2 + IR_3$$

$$\text{Or } V = I(R_1 + R_2 + R_3) \text{ -------------------- } (1)$$

If R is the equivalent resistance of R_1, R_2 and R_3 then $V = IR$ -------------- (2)

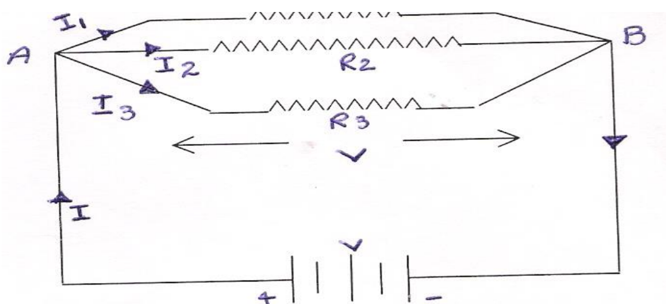
From =n 1 & 2 we get

$$IR = I(R_1 + R_2 + R_3)$$

$$\text{Or } R = R_1 + R_2 + R_3$$

Thus the equivalent resistance of a series combination is equal to the sum of the individual resistances. This arrangement is, therefore, used to get a large resistance from a number of given small resistances such as those provided in the resistor box.

Resistance in Parallel: - Resistances are said to be connected in parallel if they are connected across common points so that the potential difference across each of them is equal to the applied potential difference.



In figure three resistors R_1, R_2 and R_3 are connected in parallels between the points A & B. If I be the total current, at point A, it is branched into I_1, I_2 and I_3 through the resistors R_1, R_2 and R_3 respectively so that $I + I_1 + I_2 + I_3$ ------------ (1)

Let the P. D. between the points A & B is V, then the current flowing in the individual resistors are given by $I_1 = V / R_1$, $I_2 = V / R_2$,$I_3 = V / R_3$

Put these values in =n 1, we get

$$I = V / R_1 + V / R_2 + V / R_3$$

$$I = V [1/R_1 + 1/R_2 + 1/R_3]$$ --------------- (2)

If R be the total resistance between A & B, then

$$I = V / R$$ ------------------(3)

From =n's 2 & 3 we get

$$V / R = V [1/R_1 + 1/R_2 + 1/R_3]$$

$$\text{Or } 1/R = 1/R_1 + 1/R_2 + 1/R_3$$

Thus the reciprocal of the equivalent resistance is equal to the sum of the reciprocal of individual resistances and is used to decrease the total resistance of the circuit.

Q#12 What possible values of the resultant resistance one can get by combining tow resistances one of values 2Ω and the other 6Ω?

Ans: Here $R_1 = 2\Omega$, $R_2 = 6\Omega$

In series the combined resistance Rs is given by

$Rs = R_1 + R_2 = 2\Omega + 6\Omega = 8\Omega$

In parallel the combined resistance Rp is given by

$1 / Rp = 1/R_1 + 1/R_2$ or $1/Rp = 1/2 + 1/6$ or $1/Rp = \frac{3 + 1}{6} = 4/6$

or $Rp = 6/4 = 1.5\Omega$

Q#13 What is heating effect of current?Explain why heat is produced, when a current passes through a resistance? Obtain an expression for the heat produced.

Ans. Heating effect: - In 1841, joule experimentally showed the heating effect of the electric current. When electric current flows through a conductor, it becomes hot after some time. This indicates that the electrical energy is being converted into heat energy. This effect is known as heating effect of current or Joule's heating effect.

Cause of heating effect: - A large number of free electrons is always available in every conductor. When a potential difference is applied at the ends of a conductor these free electrons try to move from the end of lower potential to the higher potential. As they move, they collide against the ions or atoms in the conductor and in this process, the electrons transfer their K.E. to the atoms. As a result the average K.E. of the atoms increases and thus the temperature of the conductor rises. Thus the conductor gets heated due to flow of electric current through it. It is termed as heating effect of the electric current.

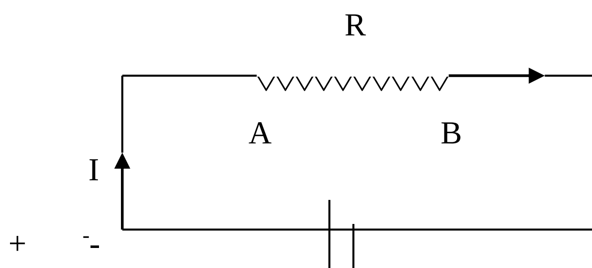
Q#14 What is Joule's law? Establish the Joule's law.

Ans. The law concerning the development of heat by electric current was first established by Dr. Joule in 1841. The law is known as Joule's law.

Establishment of Joule's law: - Suppose P. D. is applied across the ends of the conductor AB is V and its resistance is R. A current I flows through the conductor for an interval t.

Total charge flowing from A to B in time t is given by

$$q = I \times t$$



The work done in carrying total charge q Coulomb against a potential difference of v volt is

$$W = v \cdot q = V \cdot I \cdot t \text{ joule}$$

Now $V = IR$ [from Ohm's law]

$$\therefore W = I^2 Rt \text{ Joule}$$

This work will be converted into heat then amount of heat produced H is given by

$$H = W = I^2 Rt \text{ Joule}$$

$$\text{Again } I = \frac{V}{R}$$

$$\therefore H = (V/R)^2 \times Rt = \frac{V^2}{R^2} \times R.t \text{ joule} = \frac{V^2}{R} \times t$$

$$\therefore H = V.\ I \times t = I^2 R\ t = V^2 / R\ t \text{ joule.}$$

If heat is measure in calories then

$$H = \frac{V.\ I.\ t}{4.18} = \frac{I^2 R\ t}{4.18} = \frac{V^2 t}{R \times 4.18} \text{ Calories}$$

(1 cal = 4.18 J & 1J = 1 / 4.18 c)

Q#16 Explain electric power and give its units.

Ans. **Electric Power: -** The ratio at which work is done in maintaining the current in electric circuit is called electric power of the circuit.

If a current I amperes flows through a conductor for a time t seconds under a P. D. of V volt, then work done to maintain the current in the circuit is given by

$$W = V \times I \times t \text{ joule}$$

$$\therefore \text{Electric power, } P = \frac{\text{work done}}{\text{time taken}}$$

$$\text{Or } P = \frac{V \times I \times t}{t} = V \times I \text{ Watt or } J / S$$

Thus power of 1 watt is defined as the rate of working of 1 joule / sec.

Thus 1 w = 1j /1s = 10^7 ergs / sec.

Since P = V x I watt or j / s

$\therefore$ Power (in watt) = V (in volt) x I (in ampere)

Or I W = 1 V x 1A = 1 ampere – volt.

Thus power of an electrical current is said to be 1 watt, if one ampere current flows in its. When a P.D. of 1 volt is applied across it.

The bigger units of electric power are kilowatt (KW) and megawatt (MW)

1 KW = 1000 watt and 1 MW = 10^6W

Some other formula for calculating power :-

Since $P = V \times I$ -------------------- (1)

From Ohm's law, we have $V / I = r$ or $V = IR$

From (1) we get $P = I^2R$

Or $P = (V/R)^2 \times R$

Or $P = V^2/R^2 \times R = V^2/R$

Thus $P = V \times I = I^2R = V^2/R$

Problem :- An electric bulb of 40w is connected to a source of 220v.

i) What will be the current drawn by the bulb?

ii) . What is the resistance of the bulb?

Sol. Since $P = V \times I$ or $I = 40 / 220 = 2 / 11$

Thus current I = 0.182 amperes

Also $P = V^2 / R$ so $40 = \frac{(220)^2}{R}$

$=> 40 \times R = 220 \times 220$

$=> R = \frac{220 \times 220}{40}$

R = 1210

Thus, resistance R = 1210 Ohm's Or V / I = R

So $\frac{220 \times 11}{2} = R = 1210$

Thus, resistance, R = 1210 Ohm's

Problem:- What is the power consumed in an electrical heater consuming a current of 10A, if its coil resistance is 20 Ohm?

Sol: Here I = 10A, R = 20Ω

$P = 1^2R$

Or $P = (10)^2 \times 20 = 2000w$

Q#17 What is electric energy? Give its unit.

Ans. The total work done in maintaining the current in the circuit for a given time is called electric energy consumed in the circuit. The total energy consumed depends upon the power and time.

Electrical energy, $W = P \times t$ joule

But $P = V \times I$

$\therefore W = V \times I \times t$ joule.

S.I. unit of electric energy is joule, where

1 joule = 1 volt × 1 amp × 1 sec

Or 1 joule = 1 watt × 1 sec.

The commercial unit of electric energy is called kilo-watt hour (kWh) or Board of trade unit (B.O.T.U) where 1 kwh = 1 kilowatt x 1 hour

= 1000 watt × 1 hour

$= 10^3$ j/s x (60 x 60)s because 1 w = 1 j / 1s

$= 10^3 \times 3600$ j

$= 36 \times 10^5$ j

1 kwh $= 3.6 \times 10^6$ j

The number of units consumed in an electric circuit is given by

$$\text{B.O.T Units} = \frac{\text{watt} \times \text{hour}}{1000} = \frac{\text{volt} \times \text{ampere} \times \text{hour}}{1000}$$

Kilo watt hour is the unit of electrical energy for which we pay to the electricity supply department of our city. One unit of electricity costs anything from 2 rupees to 4 rupees. Now,

by saying that 1 unit of electricity cost 2 rupees , we mean that 1 kwh of electrical energy costs 2 rupees .

<u>Problem :-</u> An electric heater is rated at 2 kw. What is the cost of using it for 2 hours a day for the month of April if each unit costs Rs2?

Sol. Here voltage = 2 kw = 2000w

Time = 2 x 30 = 60hr (2 hours per day for 30 days of April)

$$\text{Energy consumed (in kwh)} = \frac{\text{watt x hour}}{1000} = \frac{2000 \times 60}{1000} = 120 \text{ kwh}$$

Cost of using heater = 120 x 2 = Rs 240.

Q#18 What are the applications of heating effect of electric current?

1. Some electrical appliances like electric lamps, electron iron, toaster, electric kettle, room heater, hot plates, geyser, hair drier, electric blanket etc. are based upon heating effect of electric current.
2. The filament in electric bulbs gets heated to white hot and emits light.

3. Electric fuse is another very important application of heating effect of current when the current in the circuit is very large, the fuse wire melts and breaks the circuit, thereby saving the main installation from being damaged.

Power rating of a few common electric appliances and the current drawn by them.

Electric appliances	**Power**	**Current drawn at 220 w supply**
Tube light rod	40w	0.18A
Tube with choke	50w	0.23A
Stereo set	10w – 200w	0.15 – 091A
Colour T.V.	60w	0.27A
Refrigerator	150w	0.68A
Fan	70w	0.32A
V.C.R.	30w	0.14A
Transister set	5w	0.02A
Electric iron	450w – 1000w	2.05 – 4.5A
Room heater (1 rod)	1000w	4.55A
Geyser	1500w	6.82A
Motor (1 hp)	750w	3.41A

Textual Questions

Q#1 Name a device that helps to maintain a potential difference across a conductor.

Ans. A battery or a cell.

Q#2 What is meant by saying that the potential difference between two points is 1V?

Ans. It means 1Joule of work is done in moving 1 coulomb of electric charge from one point to another.

Q#3 How much energy is given to each coulomb of charge passing through a 6V battery?

Sol.

$$\text{Potential difference (V)} = \frac{\text{Work done}}{\text{Charge moved}}$$

$$V = \frac{W}{Q}$$

$$W = V \times Q$$

$$W = 6 \times 1 \quad \Rightarrow \quad W = 6 \text{ Joules}$$

Thus, the energy given to each coulomb of charge is 6 Joules.

Q#4 On what factors does the resistance of a conductor depend?

Sol. The resistance depends on length of conductor, area of cross section of conductor, nature of material and temperature of the conductor.

Q#5 Will current flows more easily through a thick wire or a thin wire of same material, when connected to same source? Why?

Sol. Since the resistance of a conductor is inversely proportional to its area of cross section i.e.

$$R \propto \frac{1}{A}$$

Thus, a thick wire which has a greater area of cross section has lesser resistance than a thin wire having smaller area of cross section thus, current flows more easily through a thick wire than a thin wire.

Q#6 Let the resistance of an electrical component remains constant while the potential difference across the two ends of component decreases to half of its formal value. What change will occur in current through it?

Sol According to Ohm's law, "At constant temperature, the current flowing through a conductor is directly proportional to the potential difference across its ends for the same resistance" thus, when potential difference decreases to half, current also becomes half of its previous value.

Q#7 Why are coils of electric toasters and electric irons made of an alloy rather than a pure metal?

Sol. It is because:

i) The resistivity of an alloy is much higher then that of pure metal.
ii) An alloy doesn't undergo oxidation easily even at high temperature, when it is red hot.
iii) It has a high melting point.

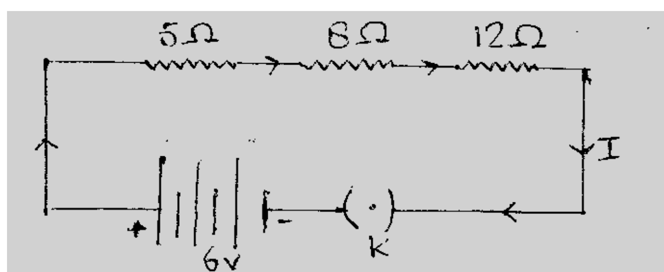
Q#8 Which among Mercury and Iron is a better conductor?

Sol. Iron is better conductor then Mercury.

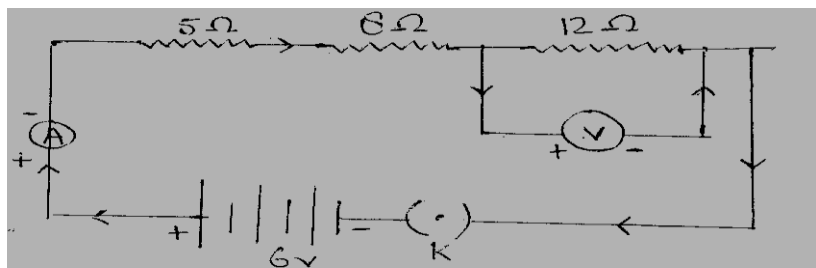
Q#9 Which material is better conductor?

Sol. The materials having low resistivity are better conductors. Thus, silver is the best conductor

Q#10 Draw a schematic diagram of a circuit consisting of a battery of three cells of 2V each, a 5Ω resistor, an 8Ω resistor, and a 12Ω resistor, and a plug key, all connected in series.



Q#11 Redraw the circuit of question 1, putting in an ammeter to measure the current through the resistors and a voltmeter to measure the potential differences across the 12Ω resistor. What would be the readings in the ammeter and the voltmeter?



For the whole circuit
Total resistance = 5Ω + 8Ω + 12Ω = 25Ω
Total voltage = 2V + 2V + 2V = 6V
Thus, current flowing through the resistors

$$I = \frac{V}{R} = \frac{6V}{25\,\Omega} = 0.24A$$

So, the ammeter will show a reading of 0.24 A.
Voltage across the 12Ω resistor = I × R = 0.24A × 12Ω = 2.88Ω
So, the voltmeter will show a reading of 2.88V

Q#12 Judge the equivalent resistance when the following are connected in parallel

a) 1Ω and $10^6\Omega$ (b) 1Ω and $10^3\Omega$ and $10^6\Omega$.

a) The equivalent resistance = $1 + \frac{1}{10^6}\ \Omega$

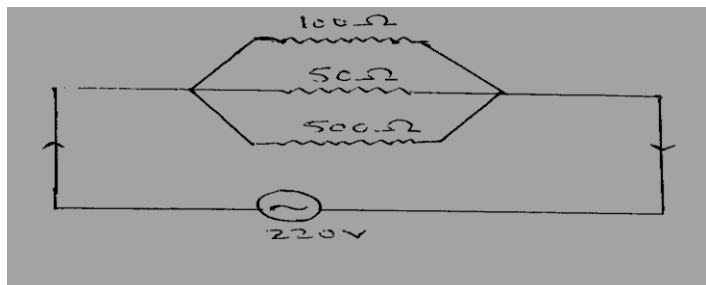
Since, $\frac{1}{10^6} \cong 0$

Thus, the total resistance = 1 Ω approximately.

b) Similarly, the total resistance = 1Ω when 1Ω , 10^3 Ω and 10^6 Ω resistors are connected in parallel.

Q#13 An electric lamp of 100Ω , a toaster of resistance 50Ω and a water filter of resistance 500Ω are connected in parallel to 220V source. What is resistance of an electric iron connected to the same source that takes as much current as all three appliances and what is current through it?

Sol. Effective resistance =?



$$\frac{1}{R_{eff}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_{eff}} = \frac{1}{100} + \frac{1}{50} + \frac{1}{500}$$

$$\frac{1}{R_{eff}} = \frac{5 + 10 + 1}{500}$$

$$\frac{1}{R_{eff}} = \frac{16}{500}$$

$$R_{eff} = \frac{500}{16}$$

$$\therefore I = \frac{V}{R_{eff}} = \frac{220}{500/16} = \frac{220}{500} \times 16 = \frac{176}{25} = 7.04 \text{ A}$$

So, I = 7.04 Amperes.

Now, I_{iron} = 7.04A

V = 220V

$$\therefore R = \frac{V}{I} = \frac{220V}{7.04A} = 31.25\ \Omega$$

Thus, the resistance of electric iron should be 31.25Ω

Q#14 What are the advantages of connecting electrical devices in parallel with the battery instead of connecting them in series?

Ans. Advantages of connecting electrical devices in parallel are:

i) In parallel circuits even if one appliance becomes faulty, all other appliances keep working normally.

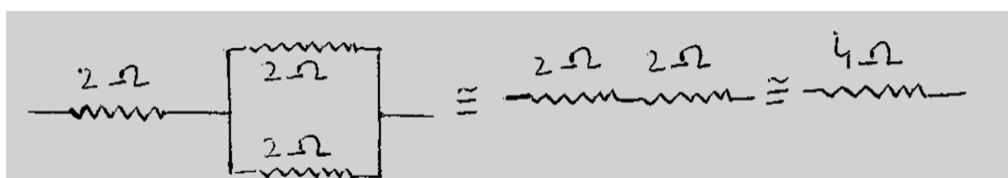
ii) Each electrical appliance has its own switch and can be turned on or off independently.

iii) Each electrical appliance gets the same voltage as that of the power supply.

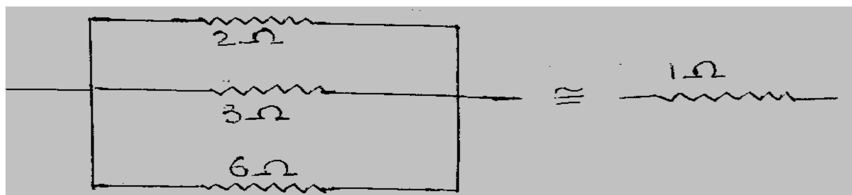
iv) Overall resistance of the circuit gets reduced, so current from the power supply is high.

Q#15 How can three resistors of resistances 2Ω , 3Ω and 6Ω be connected to give a total resistance of a) 4Ω b) 1Ω?

Ans. To get a total resistance of 4Ω , possible combination can be.



ii) To get the total resistance of 1Ω , the resistors should be connected in parallel



Q#16 What is highest resistance and the lowest resistance that can be secured by combination of four coils of resistance?

4Ω , 8 Ω , 12Ω , 24Ω?

Sol. The highest resistance is obtained by combining resistances in series

i.e. $R_{eff} = R_1 + R_2 + R_3 + R_4$

$R_{ee} = 4 + 8 + 12 + 24$

R (Highest) = 48 Ω

The lowest resistance is obtained by combining resistance in parallel.

$$\frac{1}{R_{eff}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$$

$$\frac{1}{R_{eff}} = \frac{1}{4} + \frac{1}{8} + \frac{1}{12} + \frac{1}{24}$$

$$\frac{1}{R_{eff}} = \frac{6 + 3 + 2+1}{24} = \frac{12}{24}$$

$$R_{eff} = \frac{24}{12} = 2\Omega$$

R (lowest) = 2Ω

Q#17 Why does a cord of an electric heater not glow while the heating current does?

Sol. The heating element glows because it becomes red-hot due to large amount of heat produced on passing current because of its high resistance but the cord doesn't glow because negligible heat is produced on passing current through it (because of its low resistance).

Q#18 Compute the heat generated while transferring 96000 coulomb of charge in one hour through a potential difference of 50V.

Ans We know that

$$\text{Current, } I = \frac{Q}{T} = \frac{96,000}{1 \text{ hr}} = \frac{96000 \text{ C}}{3600 \text{ S}}$$

I = 26.67 A

By using Ohm's law

$$R = \frac{V}{I} = \frac{50}{26 .67} = 1.87\Omega$$

∴ Heat generated, $H = I^2Rt$

$= (26.67)^2 \times 1.87 \times 3600 = 4788400$ Joules = 4788.4 KJ.

Q#19 An electric iron of resistance 20Ω takes a current of 5A. Calculate heat developed in 30 seconds.

Sol. R=20Ω , I = 5A , T = 30S

$H = I^2 \times R \times T$

$H (5)^2 \times 20 \times 30$

$H = 25 \times 20 \times 30$

Heat produced = 15000 Joules.

Q#20 What determines the rate at which energy is delivered by a current?

Sol. Electric power or Wattage

Where $P= V \times I = I^2R = V^2/R$

Q#21 An electric motor takes 5A from 220V line. Determine power of motor and energy consumed in 2h?

Sol. Power of the motor = VI = $220 \times 5 = 1100$ Watt.

Now, Energy consumed by motor in 2 hours = $P \times T = 1100 \times 2 \times 60 \times 60$

$= 2200 \times 3600 = 792 \times 10^4$ Joules

Q#22 A piece of wire of resistance R is cut into five equal parts. These parts are then connected in parallel. If the equivalent resistance of this combination is R' then the ratio R/R/ is-

a) 1/25 b) 1/5 c) 5 d) 25

Ans. The resistance of each part will be one- fifth (1/5) of the original resistance i.e. R/5.

When these resistances each having a resistance of R/5 Ohm's are connected in parallel, then

$$\frac{1}{\text{Eq. resistance } R} = \frac{1}{R/5} + \frac{1}{R/5} + \frac{1}{R/5} + \frac{1}{R/5} = \frac{25}{R/5}$$

So, Eq. resisitance, $R^{/} = R/25$

$$\text{Then} \quad \frac{R}{R^{/}} = \frac{R}{R/25} = 25$$

Q#23 Which of the following terms does not represent electrical power in a circuit?

a) I^2R b) IR^2 c) VI d) V^2/R

Ans. b) IR^2

Q#24 An electric bulb is rated 220V and 100W. When it is operated on 110 V, the power consumed is

Sol. Power = 100W

V = 220 V

$$\therefore P = \frac{V^2}{R} \quad \text{or} \quad R = \frac{V}{P} = \frac{2220 \times 220}{100} = 484\ \Omega$$

Now R remains same.

$$\therefore \text{Power consumed at 110 V} = \frac{V^2}{R} \quad \text{where } V = 110V,\ R = 484\ \Omega$$

$$= \frac{110 \times 110}{484} = 25\ W.$$

Q#25 Two conducting wires of the same material and of equal lengths and equal diameters are first connected in series and then parallel in a circuit across the same potential difference. The ratio of heat produced in series and parallel combinations would be-

a) 1 : 2 b) 2 : 1 c) 1 : 4 d) 4 : 1

Ans. Support the resistance of each one of the two wires be x.

Total resistance in series, R = x + x =2x

So, heat produced, Hr = $I^2Rt = I^2 \times 2x \times t$ -------- (1)

Total resistance in parallel arrangement, R= x/2

So, heat produced, $H_p = I^2Rt = I^2 \times x/2 \times t$ -------- (2)

$$\therefore \frac{H_r}{H_p} = \frac{I^2 \times 2x \times t}{I^2 \times x/2 \times t} = \frac{2 \times 2}{1} = \frac{4}{1}$$

Or Hr : Hp = 4 : 1

Q#26 How is a voltmeter connected in the circuit to measure the potential difference between two points?

Ans. In parallel

Q#27 A copper wire has diameter 0.5mm and resistivity of $1.6 \times 10^{-6}\Omega$. What will be the length of this wire to make its resistance 10Ω? How much does the resistance change if the diameter is doubled?

Ans Resistivity of copper, $\rho = 1.6 \times 10^{-6}\Omega$cm
Diameter of circle = 0.5mm
$\therefore$ Radius of wire = 0.5 /2mm = 0.25 mm
= 0.25 /10cm = 0.025 cm
So, Area of cross section of wire
$A = \pi r^2 = 3.141 \times (0.025\text{cm})^2$
Using the formula

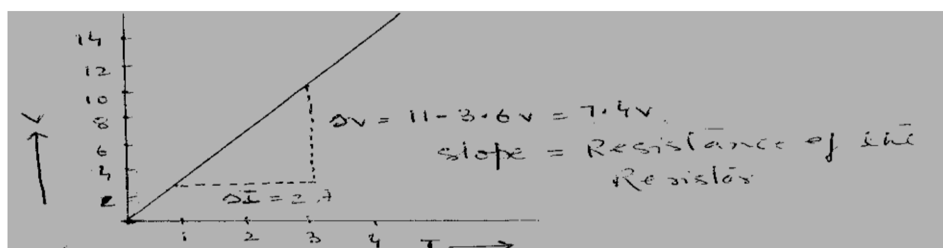
$$\rho = \frac{R \times A}{L}$$

$$\text{Or } L = \frac{R \times A}{\rho} = \frac{10\Omega \times 3.141 \times (0.025\text{cm})^2}{1.6 \times 10^{-6}\ \Omega\text{ cm}}$$

L = 12270 cm = 122.7 m
Thus the length of copper wire required to make 10Ω resistances will be 122.7 meters.
b) The resistance of a wire is inversely proportional to the square of its diameter or radius. So, when the diameter of wire is doubled, then its resistance will become $(1/2)^2$ 0r ¼ (one- fourth)

Q#28 The value of current I flow in a given resistor for the corresponding values of potential difference V across the resistor are given below:
I(amperes) 0.5 1.0 2.0 3.0 4.0
V(volts) 1.6 3.4 6.7 10.2 13.2
Plot a graph between V and I calculate the resistance of that resistor.

Ans. The graph between V and I is given below:
The graph is a straight line passing through the origin (0, 0)
From the Ohm's law V = IR
Thus, the slope of V verses I plot should be equal to R (The resistance of the conductor)
From the graph
Slope = $\Delta V / \Delta I$ = 7.4 V / 2A = 3.7 Ohm's
Thus the resistance of the conductor is 3.7 Ohm.



Q#29 When a 12V battery is connected across an unknown resistor, and there is a current of 2.5mA in the circuit. Find the value of the resistance of the resistor?

Ans. Voltage V = 12V

Current I = 2.5mA = $2.5 / 10^3$A = $25/10^4$A = 25×10^{-4} A

$\therefore$ Resistance R = V/I = 12V/ **25** $\times 10^{-4}$ A = $0.48 \times 10^4\Omega = 4.8 \times 10^3\Omega$

Q#30 A battery of 9 V is connected in series with resistors of 0.2Ω , 0.3, 12, 0.4, 0.5 and 12Ω respectively. How much current will flow through 12 Ω resistor?

Sol. $I = \frac{V}{R_{eff}}$

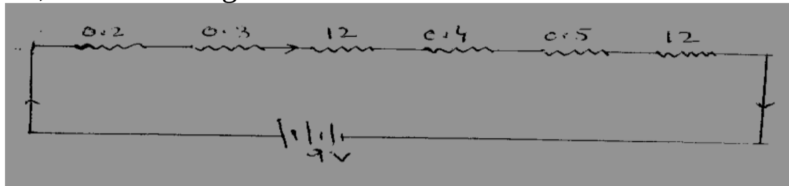
R_{eff} in series = $R_1 + R_2 + R_3 + R_4 + R_5 + R_6$ = 0.2 +0.3 + 12 + 0.4 + 0.5 + 12 = 25.4 Ohm

$\therefore$ Current thought the circuit

$I = \frac{V}{R} = \frac{9V}{25.4} = 0.35A$

In series current remains same

So, current through 12Ω is 0.35A.



Q#31 How many 176Ω resistors (in parallel) are required to energy 5A on 220V line?

Sol. $V = \frac{IR}{n}$

Where n= no. of resistors connected in parallel

$220 = 5 \times \frac{176}{n}$ (V=220, I = 5 , R = 176)

$n = \frac{5 \times 176}{220}$

=> n= 4

$\therefore$ 4 resistors are connected in parallel.

Q#32 Several electric bulbs designed to be used on 220V electric supply line are rated 10W. How many lamps can be connected in parallel with each other across the two wires of 220 V line if maximum allowable current is 5A?

Sol Power 10W

Voltage = 220V

$\therefore R = \frac{V^2}{P} \quad \left(\text{as } P = \frac{V^2}{R}\right)$

$$R = \frac{(220)^2}{10} = \frac{220 \times 220}{10} = 4840\Omega$$

As Voltage = 220V

Current = 5A

Resistance = 4840Ω

Let no. of resistances = n.

As resistors are connected in parallel

$$\therefore \quad V = \frac{IR}{n}$$

$$220 = \frac{5 \times 4840}{n}$$

$$\text{Or} \quad n = \frac{5 \times 4840}{220} = 110 \text{ bulbs}$$

So, 110 bulbs are connected in parallel to draw maximum current of 5A.

Q#33 A hot plate of an oven connected to a 220V line has two resistance coils A and B, each of 24 and 12 Ohm resistance, which may be used separately , in series or in parallel. What are the currents in these three cases?

Ans. Voltage V = 220V

Resistance $R_1 = 24\Omega$

Resistance $R_2 = 12\Omega$

Case1:- When resistances are connected in series

Then total resistance $R = R_1 + R_2 = 24\Omega + 12\Omega = 36\Omega$

Thus the current I = V /R = 220/36 = 6.1A

Case2:- When resistances are connected in parallel

$$\text{Then} \quad \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{24} + \frac{1}{12} = \frac{1+2}{24} = \frac{3}{24} = \frac{1}{8}$$

⇨ R = 8Ω

Thus current I = V/R = 220/8 = 27.5A

Case3:- When resistances are used separately

For R= 24Ω

Current I = V/R = 220/24 = 9. 16 A

For R = 12Ω

Current I = V/R = 220/12 = 18.33A.

Q#34 Compare the power used in 2Ωresistors in each of following circuits?

i) A 6V battery in series with 1Ω and 2Ω?

Sol. Resistors are connected in series.

∴Total resistance = $R_1 + R_2$ = 2+1 = 3Ω

We know, V = IR

I = 6/3 = 2A.

∴ Total power generated VI = 2 ×6 = 12 Watt.

Power generated across 2 Ω = $I^2R = (2)^2 \times 2$ = 8 Watt.

ii) A 4V battery in parallel with 12Ω & 2Ω resistors.

Sol. As in parallel the potential difference remains same.

∴ Potential across 12 and 2Ω is same = 4V

=> $P = V^2/R$

∴ Power generated across 2Ω = 16 /2 = 8Watt.

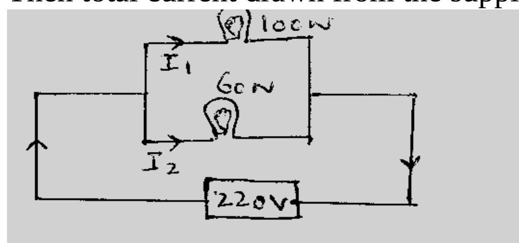
Q#35 Two lamps one rated 100W at 220V and the other 60 W at 220V are connected in parallel to electric mains supply. What current is drawn from the line if the supply voltage is 220V?

Ans. Since both the bulbs are connected in parallel and to a 220V supply, the voltage across each bulb is 220V,

Then current drawn by 100W bulb I_1 = P/V = 100W/ 220V = 0.454A

Current drawn by 60 W bulb I_2 = P/V = 60W/220V= 0.273A

Then total current drawn from the supply line = $I_1 + I_2$ = 0.454 + 0.273 = 0.727A



Q#36 Which one uses more energy?

a) 250 WTV set in 1 hr. or b) 1200 W toaster in 10 minutes.

Sol. Energy used in 250 W TV set = P ×T = 250W × 1hr = 250/1000 KW × 1hr

= 0.2KWH

b) Energy used in 1200 W toaster = P × T

= 1200 watt × 10 minutes

= 1200/1000KW × 10/60hr = 0.2KWH

So, TV set uses more energy.

Q#37 An electric heater of resistance 8Ω draws 15A from service mains 2 hours, calculate the rate at which heat is developed in heater.

Sol. The rate at which heat is produced

= $I^2 R = (15)^2 \times 8$ = 1800Watt = 1800 J/S

Q#38 a) Why is Tungsten used almost exclusively for filament of electric lamps.

Ans. Tungsten is used in filaments of electric lamps because Tungsten has a very high melting point (3380^0C), high flexibility and low rate of evaporation at high temperature.

b) Why are conductors of electric heating devices, made of alloy rather than pure metal?

Ans. Because alloys do not oxidize readily at high temperature.

c) Why is series arrangement not used for domestic circuits?

Ans. Because of following reasons:

1) In series circuit, if one electrical appliance stops working due to some defect, then all other appliances also stop working.
2) In series circuit, all electrical appliances have only one switch due to which they can't be turned on or off separately.
3) In series circuit, the appliances don't get the same voltage as that of the power supply line.
4) In the series connection of electrical appliances, the overall resistance of the circuit increases too much due to which the current from the power supply is low.

d) How does the resistance of a wire vary with its area of cross-section?

Ans. The resistance of a wire is inversely proportional to the area of cross-section.

e) Why copper and aluminium wires are usually employed for electricity transmission?

Ans. Because copper and aluminium have very low resistivities (due to which they are very good conductors of electricity) and thus they are employed for electricity transmission.

Q#19 Write a note on household electric circuit or domestic wiring.

Ans. Electricity is delivered to our houses with the help of a three core wiring called the live, the neutral and the earth. The live wire is red in colour and is at a high potential of 220v whereas the neutral wire is black in colour and is at the ground potential of zero volt. The earth wire is green in colour and is connected to the metal body of electric appliance. The earth wire is an uncovered copper wire.

The two wires live and neutral coming from the pole, enter a box in which a high rating fuse of about 50 amperes is used. Then they enter the electricity meter which records the electrical energy consumed by us. The two wires coming out of the meter are connected to a main switch S. After the main switch, there is another fuse in the live wire. This is called consumer's fuse. Usually a large number of pairs of wire start from the main switch and are taken to different rooms.

There are two separate circuits in a house, the lighting circuit with a 5A fuse and the power circuit with a 15A fuse. Different types of common domestic circuits are employed in houses. Each distribution circuit is provided with a fuse, which is connected in series. All the distribution circuits are connected in parallel because of the following reasons:-

1. Each appliance can be operated by an independent switch.
2. Each appliance works to its maximum capacity as the P.d. in parallel circuit does not change.

Q#20 At what voltage and frequency a.c. is supplied to our houses? What is domestic and power line?

Ans. Alternating current (a.c) is supplied to our houses at 220 volt at 50 HZ. The line which brings current to our house is called main line and the wire as mains. The mains may bring two different amperages i.e., 5A and 15A. The supply of 5A is called domestic while 15A as the power line. The 5A domestic line is used for variety of electrical appliances like radio, T.V., bulbs, tubes etc. while as 15A power line is used for heaters, washing machines, refrigerators, coolers, room heaters etc.

Q#21 What is a fuse wire? What are the characteristics of a fuse wire?

Ans. It is safety device employed in electrical circuits to prevent the flow of large current through costly electrical appliances. It is the weakest point in an electrical current, which melts and breaks the electrical current, when circuit gets:

1. Over loaded due to large withdrawal of current.
2. Due to short circuiting.
3. Due to fluctuation of current in power supply system.

It is generally prepared from tin-lead alloy (63% tin + 37%lead). It should have high resistance and low m.p. It is used in series with the electrical appliances. All of a sudden, if strong current flows, the fuse wire melts away due to excessive heating causing the breakage in the circuit. Thereby saving the main installation from being damaged. Thus very cheap fuse wire is capable of saving very costly appliances.

Characteristics of a fuse: -

1. It has a low melting point. Generally it melts around 200^0c.
2. It has a high resistance thus when current exceeds certain limit, its temperature rises rapidly and it melts away.

Q#22 State the hazards associated with the electricity.

Ans. Electricity is the most important and easily available source of energy. Electricity has made our life easier. However, its improper use leads to the following hazards or dangers:-

1. When the live wire is touched, electricity passes through our body and can lead to various metabolic disorders leads to death.

2. Short-circuiting due to damaged wiring or overloading of the circuit can cause electrical fires in a building.
3. Loose connections, defective switches and sockets can cause sparking which may lead fires.

Q#23 State the important precautions, which should be observed in the used of electricity.

Ans. Some of the essential precautions to be observed are:

1. The main switch should be turned off at once whenever there is sparking or fire.
2. The person who happens to touch the live electric wire should be provided an insulated support.
3. All the electric appliances should be earth connected to prevent us from electric shock.
4. All the switches should be put be put in the live wire of the A.C circuit.
5. The fuse should always be connected on the live wire of the circuit. It should be of proper rating and material.
6. All the wire connections should be tight.
7. The electrical tools should have properly insulated handles.

Q#24 How is electricity produced in the body?

Ans. Electricity is produced in our body by nerve cells called neurons. The neuron is a kind of biological electrochemical cell and looks like an electric wire. The neuron or nerve cells produce electricity as follows:

1. In resting position or normal state, the sodium ion Na^+ concentration outside the nerve is higher than that inside the nerve cell. On the other hand the potassium ion K^+ concentration is higher inside the nerve cell than that outside. This concentration difference between the ions creates a potential difference of – 70 mv between the inside of the nerve cell and outside.
2. When an outside signal or stimulant acts on sensory organs, the nerve cell gets excited. In excited state, the neuron membrane becomes permeable to sodium ions (Na^+ ions). At this stage Na^+ start going inside the cell and K+ start going out. Due to increase in concentration of Na+ inside decrease in K+ inside, the inner side of the nerve becomes more positive and outside becomes negative the total charge of potential is 40-(-70) = 110 mv. This electric impulse of the neuron caused by operation of an ion pump system called Na+K+-At pase enzyme system (sodium ion, potassium ion, Adenosine Triphosphate). The speed of electric impulse is about 25m/s. This impulse reaches the brain. After conveying the action potential to the brain, the Na+ leaves the nerve cell by the sodium pumps and K+ re-enter the cell and original resting state is restored.



Sources Of Energy

Energy: Contrary to matter, energy neither occupies space, nor possesses mass. Hence, it is not defined on physical basis but on operational or functional basis. It produces a change or motion in matter. Hence, it is defined as "Capacity to do work". It is mainly classified as potential or kinetic energy. Potential energy is stored energy or energy of position and hence inactive. Kinetic energy is energy of motion or action i.e active energy in the process of affecting matter and hence, doing work. To illustrate this, potential energy gets stored in the leg of a foot-ball player when it is raised and as it strikes the football, it turns into kinetic energy, giving motion to the ball.

Energy in different forms such as heat, sound, electrical, mechanical, radiant (of light, of cosmic, infra red, ultraviolet rays and x-rays), chemical, atomic, nuclear energy etc.

According to the law of conservation of energy (the first law of thermodynamics), energy can be converted from one form to another form , but it can neither be created nor destroyed. In energy conversation, the energy of the universe remains constant.

Source of energy:- Any substance or process which can give or produce adequate amount of useful energy at a steady rate over a long period of time is called source of energy.
Example, Coal, Petroleum, Wind, Solar radiation etc. are the source of energy.

Characteristics of a good source of energy:

A source of energy should possess the following characteristics:

1. It should be capable of giving an adequate amount of useful energy.
2. It should be convenient to transport, store and use.
3. It should be capable of supplying the desired quantity of energy at a steady rate over a long period of time.
4. It should be economical.

Q How are the sources of energy classified?

Ans. All sources of energy can be divided into two classes:

1. Renewable sources of energy
2. Non-renewable energy

1. Renewable sources of energy:- The source which are present in an unlimited quantity in nature and get replenished through some natural processes are called renewable source of energy. Some examples are air, water, solar radiation geothermal energy, biomass, ocean waves.
2. Non- renewable sources of energy:- The sources of energy which are present in limited quantity in nature and are not replenished by any natural process are called non-renewable sources of energy. E.g. coal, petroleum, natural gas, fissionable materials like U-235, plutonium.

Coal as a fuel: - Coal is a fossil fuel found deep in coal-mines under the surface of the earth. It is a complex mixture of carbon, hydrogen, oxygen and may also contain small fractions of sulphur and nitrogen compounds. It is the most important source of energy and is therefore regarded as the backbone of the energy section of our country.

Occurrence: - It occurs in Bihar, West Bengal Madhya Pradesh, Orisa, Assam and Kashmir.

Formation of coal:- Millions of years ago as a result of earthquakes and other natural calamities, vegetable matter, dead trees and plants got buried under the surface of the earth. Under the influence of high pressure, temperature and absence of air, the buried matter got converted into coal. This process is called carbonization. During carbonization, various types coal arc produced. These are:

1. **Anthracite or hard coal:** - It is the best variety of coal and contains up to 95 % carbon. It does not produce much smoke and is generally used for domestic purposes. It has a very high calorific value and leaves behind very little ash.
2. **Bituminous or Soft Coal:** - It is a dull grey in colour and contains around 80% carbon. It is used both at home and in industry. It burns with a smoky flame, producing foul smelling gases.

3. **Lignite**:- It is brown in colour and contains 60% of carbon. It produces a fairly large amount or ash and harmful gases. Its calorific value is more than peat. It is used in thermal power stations.
4. **Peat**: It is light brown in colour. It contains 50-60% carbon. It has a very low calorific value. It burns with sooty flame and produces a large amount of ash and harmful gases.

Uses of Coal: - The Important uses of coal are mentioned as under:

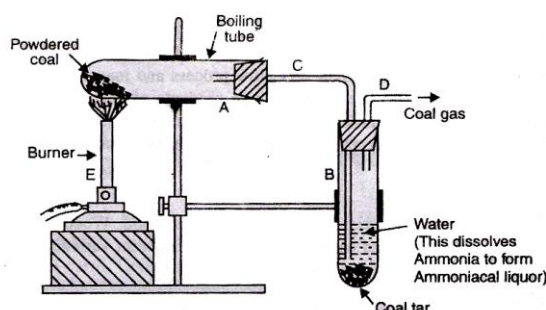
1. It is used as a domestic fuel for heating, lighting and cooking purpose.
2. It is used as fueI-in industries especially those engaged in metallurgy.
3. It is used in the production of thermal electricity at a thermal electric power station.
4. It is used in the production of coke.
5. It is used in the manufacturing of artificial or synthetic petrol and synthetic gas.

Q Define destructive distillation of coal.

Ans. The breaking down of coal by heating it at 1000-1400^{0}C in the absence of air is called destructive distillation of coal. The products obtained by the destructive distillation of coal are:

1. Coal gas 2. Coal tar 3. Coke 4. Ammonical liquor (solution of ammonia)

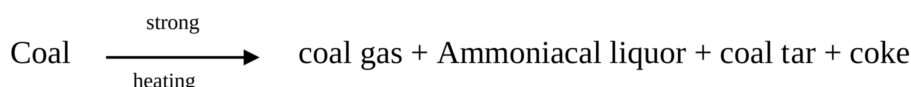
Q With the help of a labeled diagram, describe the process of destructive distillation of coal in the laboratory.



Ans. Take two hard glass tubes A and B. Put some powdered coal in the tube A and some water (20ml) in the tube B. Set the apparatus as shown in the figure by using two delivery tubes C and D. A burner E is put below the tube A containing powdered coal.

Heat the coal, first gently and then strongly. The gaseous products formed during heating are passed through the water in the tube B. Soluble substances dissolve in water and a tarry substance gets collected at the bottom of this tube. The uncondensed and insoluble gas leaves from the exit tube D. This gas is called coal gas.The black Residue left in the boiling tube A is called coke. The dark tarry substance collected at the bottom of tube B is called coal tar. The aqueous solution in tube B is called ammoniacal liquor.

Thus,



Q Give the composition of coal gas and its uses.

Ans. Coal gas is a mixture of hydrogen (38-55%), Methane (15-22%), carbon monoxide (4-15%) and Nitrogen (2-20%). This mixture of gases is called excellent fuel having high calorific value. It is obtained by the destructive distillation of coal.

The various uses of coal gas are given below:

1. Coal gas is used as a gaseous fuel in industries.
2. It is used as reducing agent in various metallurgical operations.
3. It was used in street lightening as illuminant.
4. It was used for domestic cooking.

Petroleum:- Petroleum is a viscous ,dark coloured (colour varying from amber to black) ,foul smelling
liquid which occur deep inside the earth. The name petroleum is derived from two words petra means rock and oleum means oil. Therefore, it is also known as rock oil. It is called petroleum because it is found under the surface of the earth trapped in between the sedimentary rocks and to obtain it rock is to be drilled. The crude oil (petroleum is a complex mixture of several solid, liquid

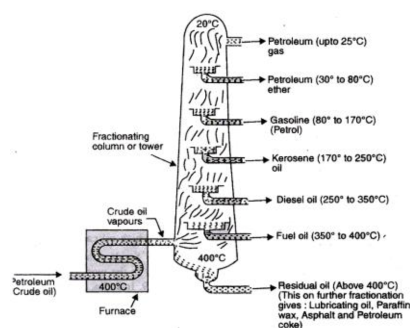
and gaseous hydro carbons mixed with saline water, salt and earth particles. The first oil well on the earth was drilled in Pennsylvania in U.S.A in the year 1859. In India the first oil well was drilled in Makum in Assam in the year 1867.

<u>Formation of petroleum</u>:-

Petroleum was formed by the decomposition of the remains of extremely small plants and animals buried under the sea bed millions of years ago. It is believed that millions of years ago, the microscopic plants (phytoplankton) and microscopic animals (zoo planktons) which lived in seas and oceans, died. Their bodies sank to the bottom of the sea and were soon covered with mud and sand. The sediments grow thicker and sink further into the sea floor under it's over weight. As additional deposited pile up, the pressure on the ones below increased several thousand times and the temperature raised by several hundred degrees. The mud and sand harden into sedimentary rock (Non porous rock). The chemical effects of pressure, heat and biological catalysts converted the remains of these microscopic organisms into petroleum. This conversion took place in the absence of air. The petroleum thus formed got trapped between the layers of impervious rocks (Non porous rocks), forming oil trap. The more volatile components of petroleum forms a gaseous cover over petroleum. Such a gaseous mixture covering the crude oil is known as natural gas.

Q Describe the process of refining of petroleum. (OR) Describe fraction distillation of petroleum. Name the products of petroleum and mention their uses.

Ans.Refining of Petroleum: Petroleum is a mixture of useful products like alkanes, cycloalkanes and some aromatic hydro carbons and to separate these useful products, petroleum is subjected to the refining process by fractional distillation "The process of separating crude petroleum oil into different useful products and the removal of undesirable impurities by fractional distillation is called refining of petroleum."



The fractional distillation of petroleum is carried out in a specially designed tower called fractionating tower. The tower consists of a number of shelves maintained at different controlled temperatures and these shelves have openings and are covered with caps called as bubble cap.

Crude oil is heated to about 400 C in a furnace. At this temperature all the components except residue vaporize .These vapors are than fed into fractionating column from near its bottom. As the vapors move up, less volatile components gets condensed in the upper part of the column. The uncondensed fraction goes out as the gas through an outlet at the top. The gas which goes out of column is known as petroleum gas. The least volatile fraction is collected from an outlet at the bottom of the column as their residue. The residue then further distilled to obtain more residue products (lubricating oil, paraffin wax, asphalt).

Various fractions obtained during the fractional distillation of petroleum fro top of the fractionating form are described below:-

S.No	Fractions	Molecular Position		Uses
1.	Petroleum gas	C_1-$C_{4/\ below\ 40}$^{0}C	i).	It is used as a fuel.
			ii)	It is used in the production of carbon black (used in tyre industry), in the production of hydrogen (used in fertilizer industry), in the production of L.P.G and the manufacture of petrol by the process of polymerization.
2.	Petrol/gasoline	C_5-$C_{10\ /\ 40\text{-}170}$^{0}C	i)	It is used as fuel in two wheelers, three wheelers and in cars.
			ii).	As a solvent in dry cleaning clothes and for making petrol gas.
3.	Kerosene	$C_{11}C_{12}$/ 170-250^{0}C	i).	It is used as a house hold fuel.
			ii).	It is used as an illuminant for lighting.
			iii).	In generators for production of current.
4.	Diesel	C_{13}-C_{15} 250- 350^{0}C	i)	As a fuel in vehicles like trucks, buses, tractors and railway engines.
			ii).	It is used in water umps and generators for their work.
5.	Fuel Oil	C_{15}-C_{18} 350-400^{0}C	i).	For making petrol by cracking.
			ii).	It is used in boilers and furnace industries because it is a better fuel than coal.
6.	Lubricating oil	C_{17}-C_{20}		It is used as a lubricating agent in various machines.
7.	Paraffin wax	C_{20}-C_{30}	i).	It is used in making candle, wax paper, grease, Vaseline and ointments.
8.	Asphalt	C_{30}-C_{50}	i).	Asphalt is used for wood surfaces, paints etc.

Q <u>Liquefied petroleum gas:-</u> Petroleum gas is a mixture of butane ,propane and ethane. The main constituent of petroleum gases however is butane. These hydrocarbons burn readily producing large amount of heat. This makes petroleum gas is very good fuel. Butane, propane and ethane are gases under ordinary pressure. However butane can be easily liquefied under ordinary pressure.

The petroleum gas, which has been liquefied under ordinary pressure, is called liquefied petroleum gas (LPG). Petroleum gas is supplied in liquid form so that a cylinder of even small volume may contain appreciable amount of gas. A domestic gas cylinder contains about 14.2 kg of LPG. A strong smelling substance called Ethyl mercaptan (C_2H_5SH) is added to L.P.G cylinder to help in the detection of gas leakage. The gas used for domestic cooking is called liquefied petroleum gas because it is present in the liquid form in the cylinder. L.P.G can also be obtained form natural gas.

Liquefied petroleum gas (L.P.G) is commonly used for domestic heating purposes. When the knob of the gas cylinder is turned on, the pressure inside the cylinder decreases and the highly volatile L.P.G vapourize and flows to the burner of the cooking stove. When ignited, the gas burns with a blue flame producing a lot of heat. 1gm of L.P.G gives about 50 kj of energy.

<u>Natural gas:-</u> Natural gas is a naturally occurring mixture of aliphatic hydrocarbons and small amounts of hydrogen. Among aliphatic hydrocarbons, it mainly contains methane (CH_4) with a little ethane (C_2H_6) and propane (C_3H_8). Methane is the principal constituent of natural gas, which is upto 97%.

<u>Occurrence</u>

Natural gas occurs deep under the earth either alone or along with petroleum deposits. Thus during petroleum mining, natural gas is always obtained as a by-product, but there are some wells that produce only natural gas.

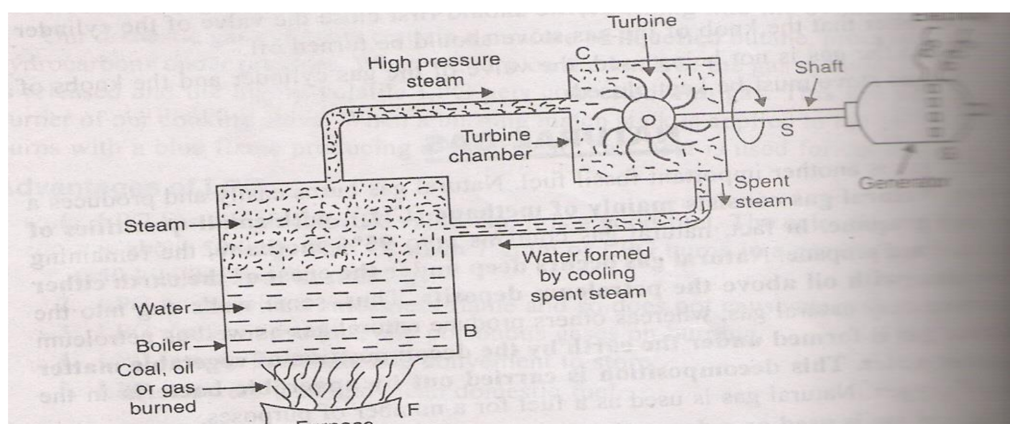
In India natural gas wells have been discovered in Tripura, off-shore-areas of Mumbai and in Krishna-Godavari Delta.

Q Explain the principle of working of thermal power plant.

Ans. A power plant in which the heat required to make steam to drive turbines is obtained by burning of fuels is called thermal power plant.

The fuel (coal, fuel or natural gas) is burned in a furnace F to produce heat. The heat produced by fuels boils the water in a boiler B to form steam, the steam formed from the boiling water builds up a pressure which is used to rotate the turbine T fitted in a checker C. The shaft (S) of the turbine is connected to a generator g. When the turbine rotates, its shaft also rotates and drives the generator the generator produces electricity. The spent steam coming out of the turbine chamber is cooled to form water. This water is again sent to the boiler to form fresh steam. This process repeats again and again.

Thus, it is the chemical energy of the fossil fuels which is transformed into electrical energy.



Q What are conventional sources of energy?

Ans. The traditional sources of energy which are familiar to most people are called conventional sources of energy. The main conventional sources of energy are wood and fossil fuels (like, coal, petroleum and natural gas). The secondary fuels obtained from these fuels are also called conventional sources of energy.

Q What is a fuel?

Ans. Fuel is a substance that reacts chemically with another substance to produce heat or a substance that produces heat by nuclear processes. The term fuel is generally limited to those substances that burn readily in air or oxygen, emitting larger quantities of heat and some times also light. Some examples of fuels are------ wood, coal, petrol, kerosene, gas and even animal refuse is used as fuel. These fuels contain carbon and burn in oxygen to produce heat and light. Fuel used in atomic reactors does not contain carbon and does not need oxygen. Thus Fuels are the concentrated store house of energy, which is released only after its being burnt.

Types of fuel:

Fuels can be classified in three different ways.

Classification based on physical state.

Fuels can be classified as solid, Liquid and gaseous depending upon the state in which the exist.

Solid fuel:- Wood ,Charcoal, Coke, Coal, Paraffin Wax etc. are examples of solid fuels as these exist in solid state.

Liquid fuel: - Diesel, Petrol, Kerosene etc. are examples of liquid fuel as these fuels exist in liquid state.

Gaseous fuel:- Liquefied petroleum gas(LPG), Biogas, natural gas, coal gas etc. are the examples of gaseous fuel as they exist in gaseous state.

Classification based on Origin:

Fuels may be classified as natural or raw fuels and artificial or processed fuels depending upon the nature of their origin.

Natural or raw Fuels:-

Fuels, which are used in the same form as they occur in nature, are called natural or raw fuels.

Example: Wood, Coal, Natural gas etc.

Artificial or Processed Fuels:-

Fuels which are prepared from natural fuels by various physical and chemical processes are called artificial or processed fuels.

Example: Charcoal, Diesel, Kerosene, Coke etc.

Classification of Fuels as Primary or Secondary Fuels

Fuels may be classified as primary or secondary fuels depending upon whether they are used as such or converted to a new fuel.

Primary Fuels

Fuels, which exist in nature and are used directly to produce heat, are called primary fuels.

Example: Wood, Coal, Natural gas etc.

Secondary Fuels

Fuels, which are derived from primary fuels, are called as secondary fuels.

Example: Coal gas, Wood gas, Water gas etc.

Characteristics (Properties) of Ideal Fuel or Good Fuel: -

To choose a fuel for the production of heat energy for domestic and industrial purposes, due consideration must be given to various parameters such as physical state of the fuel, its calorific value, its rate of combustion and so on . Some characteristics of an ideal fuel are as under:-

(i) It should have high calorific value.
(ii) It should have proper ignition temperature, such that it can be burnt easily.
(iii) It should have moderate rate of combustion i.e. it should not burn either too fast or too slow.
(iv) It should have low content of non volatile material i.e. it should not produce much ash.
(v) It should not produce any harmful gas.
(vi) The fuel should be readily available in plenty through out the year at all places.
(vii) It should not be more useful for some other purposes than a fuel.
(viii) It should have a reasonable cost so that every group of society can buy it.
(ix) It should be easy to transport, safe to handle and convenient to store.

Fossil fuels:- A natural fuel formed deep under the earth from the pre- historic remains of living organisms (like ,plants and animals) is called a fossil fuels. Coal, petroleum and natural gas are fossil fuels.

Q How fossil fuels are formed?

Ans. Fossil fuels are formed over millions of years by the burial of plants and animals remains. The plants and animals which died millions of years ago, were gradually buried deep in the earth and got covered with sediments like mud and sand, away from the reach of oxygen. The cover of the sediments prevented their oxidation and decay while the weight of sediments squeezed out the water and other volatile materials. In the absence of oxygen and under the combined effect of pressure, heat and bacteria, the buried remains of plants and animals were converted into fossil fuels like coal, petroleum and natural gas.

Q What are the disadvantages of the fossil fuels?

Ans. The main disadvantage of fossil fuels is that the burning of fossil fuels causes a lot of pollution in the environment e.g.

1. The burning of fossil fuels produces acidic gas such as sulphur dioxide and nitrogen oxides which causes acid rain.
2. The burning of fossil fuels produces large amount of CO_2 gas which increases green house effect leading to excessive heating of the earth. This is harmful for all the life on the earth.
3. The burning of fossil fuels produce smoke which pollutes the air.
4. The burning of coal leaves behind a lot of ash which causes air pollution.

Q How can we reduce air pollution?

Ans. The air pollution caused by burning fossil fuels can be controlled (reduced) by the following ways:

1. The pollution of air caused by burning petroleum fuels in vehicles can be controlled by using catalytic converters. The catalytic converter changes the harmful gases coming from the engine into harmless gases before releasing them into the air.
2. The pollution of air caused by burning coal in factories can be controlled by washing down the smoke and acidic gases by water in a scrubber. It can also be controlled by installing electrostatic gadgets in chimneys.

Q What is Biomass?

Ans The waste material of plants and animals (living objects) like cattle dung, dead parts of vegetation such as wood, leaves, agricultural wastes etc. is called Biomass. Baggers which is the dry part of sugarcane i.e. formed when juice is extracted is also included in Biomass.

Q How is Biomass used as fuel?

Ans Biomass may be used as a fuel in following two ways:-

(i) **Directly as fuel:** - Biomass can be used directly as fuel. For e.g., dry wood, dry leaves, dry cattle dung. etc. is used directly to produce heat.

(ii) **Indirectly as fuel:-** Biomass can be used indirectly by converting Biomass into better fuel:- Biomass may also be used by converting by it into a more useful fuel. For e.g.,

(a) Cattle dung may be converted into more useful fuel called Biogas.
(b) Wood may be converted into charcoal by destructive distillation.
(c) Sewage may be used for producing methane gas which can be used as a clean fuel.

Q **Traditional Chulha:-**In rural areas, dry Biomass Such as dry wood and dry dung cakes are burnt in an open fire place made of clay(commonly called as Chulha). A traditional chulha can utilized only 8-10 % of the total heat for heating and cooking. Thus traditional chulhas have poor efficiency. This is because in a traditional chulha,

(i) The fuel does not undergo complete combustion,
(ii) A large quantity of heat is lost to the environment due to its open design, and
(iii) The smoke produced spreads over the fuel and thus hinders its complete combustion.

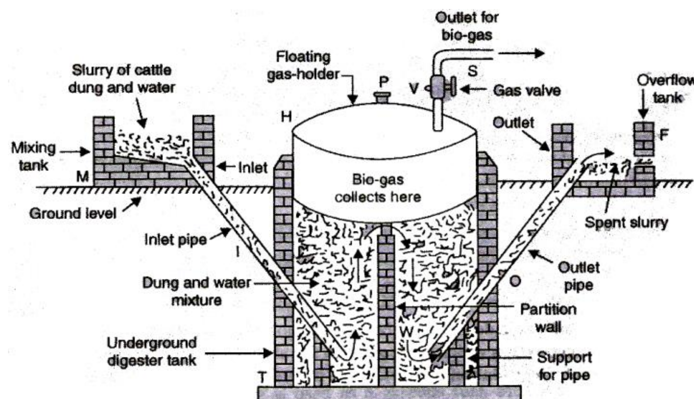
Smokeless chulhas:- The traditional chulha has a poor efficiency of only about 8-10% which leads to the wastage of the fuel. Besides the smoke produced due to incomplete combustion of the fuel is a serious health hazard. Both these problems are partially overcome in scientific design "smokeless chulha", which have better efficiency. These are so made that there is sufficient supply of air and combustion of fuel takes place almost completely. Thus these consume less fuel. Moreover in these chulhas, smoke is removed through a tall chimney attached to them. This leads to clean home and ensures better health for women and children at the ground level.

Q Difference between Smokeless chulhas and traditional chulhas

S.No	Smokeless chulhas	Traditional chulhas
1	The smokes less chulhas have more efficiency as they consume less fuel.	The traditional chuhas have poor efficiency of only about 8-10 % and the remaing 92 % is lost to the surroundings thus a lot of fuel is wasted.
2	The smokeless chulhas have a tall chimney to free the smoke in the upper atmosphere, which helps in maintaining clean environment at the ground level.	No chimney is provided to the traditional chulha so a lot of smoke produced spreads in the house resulting in many respiratory disorders in the persons living their.
3	The smokeless chulhas allow a better combustion of fuel due to which a lot of heat and less smoke is produced.	In traditional chulhas due to incomplete combustion of wood a lot of smoke and other harmful gases are produced. Heat produced is also less.

Q Draw a labeled diagram of the floating gas holder type bio-gas plant. Explain its construction and working.

Ans. **Construction: -** It consists of a well shaped, underground digester (T) which is provided with drum shaped gas holder (H) made of steel floating in the inverted position over the dung slurry in the digester tank There is a gas outlet S at the top of the gas holder tank where from the gas is taken out. The digester has a partition wall which divides the tank into two parts. There is an inlet pipe I on the left hand side of digester tank connected to mixing tank M. From the right hand side, there is an outlet pipe O connected to an over-flow tank F.



Working: - Slurry (cattle dung and water) prepared in mixing tank M is fed into the digester tank T through the inlet pipe I. The dung and water (slurry) is left in digester initially for a period of 50 to 60 days. The dung undergoes anaerobic fermentation in the presence of water with the gradual evolution of
bio-gas. The bio gas starts collecting in the gas holder H and can be taken out through the outlet S and as gas collects in drum, the pressure inside the digester increases due to which slurry is forced out into the over flow tank F through the outlet pipe O. The spent slurry is removed and hence used as manure.

Q State the important uses of bio-gas.

Ans. The important uses of bio-gas are given below:

a. Bio-gas is used as a domestic fuel for cooking food.

b. Bio-gas is used to run engines.

c. Bio-gas is used for street lightening.

Q Explain why bio-gas plants are considered to be a boon to farmers.

Ans. Bio-gas is considered a boon to the farmers because of the following reasons

a. It is used by farmers for domestic purposes like cooking etc.

b. It is used to run engines of water pumping sets.

c. All the cattle dung and agricultural wastes are utilized for making bio-gas.

d. It is used by farmers for lightening their homes as well as streets.

e. The residue of bio-gas plants is good manure for plants.

Q What is wind energy? How is it caused? What are the factors affecting wind?

Ans. Wind energy:- Flowing or moving air is called wind. The speed of wind may very from 5 – 10 km/hr (gentle breeze) to 700 – 800 km/hr (Tornado). The kinetic energy of moving air (wind) is called wind energy.

Q How is wind caused?

Ans. Solar energy is responsible for the blowing of wind. When sun rays fall on the earth, the equatorial region receive much rays than the polar regions. As a result, the air in the equilateral region becomes warm and rises. The cool air from the Polar Regions moves in to take its place. This flow of air from the cooler to the warmer regions causes wind.

The speed and the direction of wind is affected by the following factors:

1) Location on the earth.
2) Rotation of the earth.
3) Local conditions.
4) Height from the ground.

Q How can the wind energy by utilized?

Ans. The kinetic energy of wind can be utilized for doing some useful work in the following ways:

1) Wind energy is used for transporting people and materials by using sail boats.
2) Wind energy is used for pumping out underground water, grinding of grains such as wheat, grams, maize etc. by using windmills.
3) Wind energy is used for generating electricity by using windmills.

<u>Advantages of wind energy</u>:- Wind energy has the following advantages:

i) Wind energy is cheep and inexhaustible.
ii) Wind energy does not cause any pollution.
iii) It is a renewable source.

<u>Limitations of wind energy:</u>

i) Wind flowing with a sufficient speed is not available anywhere and all the time, Thus, it is not dependable source of energy.
ii) The kinetic energy of wind can be used only at the site of windmill.

Q How is wind energy exploited in our country?

Ans. In our country, a lot of work is being done to fully exploit the available wind energy some of the schemes which have been implemented are:

i) 1MW wind energy station at Okha in Gujrat.
ii) 2000 KWH wind energy station at Lmba in Gujrat. This station has 50 wind turbines spread over 200 hectars.

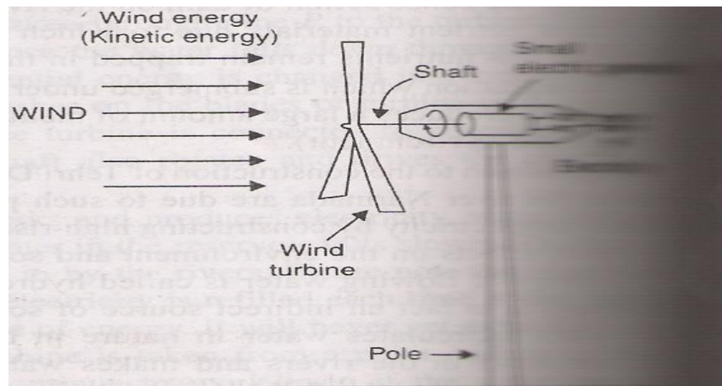
iii) The largest station established near Kanyakumari in Tamil Nadu can generate 380 MW electricity.

Q What is windmill? Explain its working.

Ans. Windmill is a device which utilizes wind energy for doing some useful work. A wind generator is used to generate electricity by using wind energy.

When wind strikes the blades of a windmill, it exerts a force on its blades. As a result, the blades start rotating. The rotational effect is due to the specially designed curved blades shaft of the wind turbine is connected to a small generator. When the wind turbine rotates its shaft also rotates and derives the generator. The generator produces electricity.

The electricity produced by a windmill is small and cannot be used for commercial purposes. So, a number of windmills are installed over a large area. Such a set-up is called a wind energy farm. The energy produced by each windmill is coupled together to produce electricity for commercial use.



Q What is non- conventional sources of energy?

Ans. Those sources of energy which are not based on the burning of fossil fuels or the splitting of atoms of nuclear fuels, are called alternative sources of energy (or non-conventional sources of energy) For example, Hydrochloric energy, wind energy, solar energy, biomass energy, energy from the sea and geothermal energy.

Q What is hydroelectricity? Explain the basic principle of its generation?

Ans. Electricity produced by making use of the kinetic energy of the flowing water is termed hydroelectricity or hydrochloric power.

The kinetic energy of water can be used for electric generation only of its flow is fast and massive. Often small rivers are located at higher altitudes in the mountainous region. Water from these small rivers can be collected in large reservoirs at higher altitude by constructing dams. The water stored in a dam has large potential energy due to its great height. The sluice gates (sliding gates) are opened to allow some of the stored water to escape. When the water is taken through tunnels, its potential energy gets converted into kinetic energy and the water comes out of the tunnels at very high speed. This fast flowing water rotates the blades of a turbine. The rotating turbine rotates the alternator of the generator, producing electrical energy.It has been estimated that the total hydrochloric power potential of India is about 4 x 10^{11} KWH. Only 11 percent of this has been utilized so for.

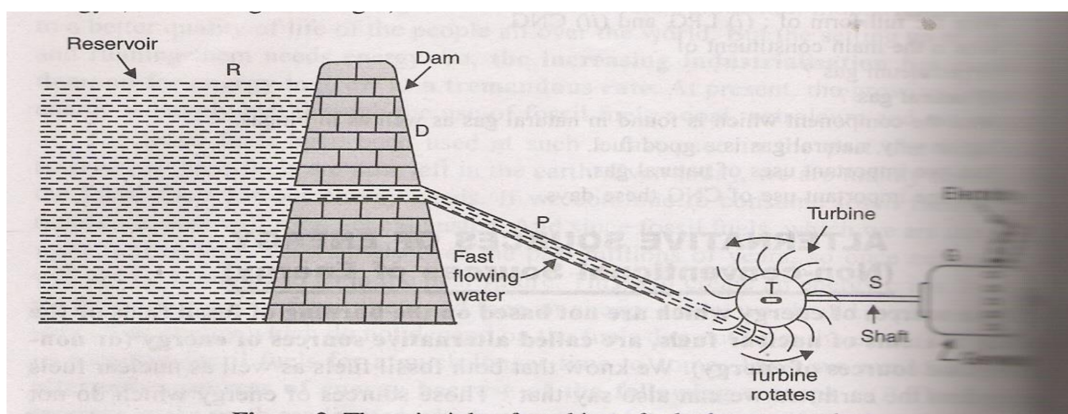


Figure 2 The principle of working of a hydro power plant

Advantages of generating hydroelectricity:

The advantages of using the energy of flowing water for the generation of electricity ate the following:

i) It does not produce any environmental pollution.

ii) Flowing water is a renewable source of electrical energy which will never get exhausted.

iii) The construction of dams, rivers helps in controlling floods, and in irrigation.

Disadvantages of generating hydroelectricity:

i) A vast variety of flora and fauna and human settlement get submerged by the stored water of the dam.

ii) High – rise dams can pose damages of earthquakes, land slides etc.

iii) It disturbs the ecological balance in the downstream area and hence soil becomes poorer in quality.

iv) The fish in the downstream area do not get sufficient nutrient materials due to which the production of fish decreases rapidly.

v) The vegetation which is submerged under water at the dam site rots under anaerobic conditions and produces a large amount of methane which is harmful for the environment.

Q Define the term nuclear fission.

Ans. Nuclear fission is the process of splitting of a heavy nucleus (usually A > 230 like U – 235) into two or more lighter nuclei with the liberation of an enormous amount of energy. For example, in 1938, Otto Hahn and Strassman discovered that when U – 235 is bombarded with slow moving neutrons, it absorbs the neutron to become U – 236 and the new nucleus is unstable. It almost at once explodes into two fragments Barium and Krypton with the emission of 3 neutrons along with 200 Mev of energy per fission. The reaction is represented as

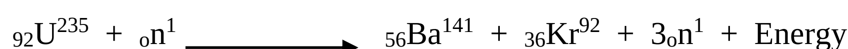


$${}_{92}U^{235} + {}_{o}n^{1} \longrightarrow {}_{92}U^{236} \longrightarrow {}_{56}Ba^{141} + {}_{36}Kr^{92} + 3{}_{o}n^{1} + \text{large amount of energy}$$

This energy appears in the form of γ - rays, K + E of fission fragments and the released neutrons.

Q What do you understand by Nuclear Chain reaction?

Ans. The nuclear reaction in which the particle (which initiates the reaction) is also produced during the reaction to carry on the reaction further and further, is called a nuclear chain reaction. The fission of U – 235 by means of slow moving neutrons is a nuclear chain reaction. The reaction is represented as

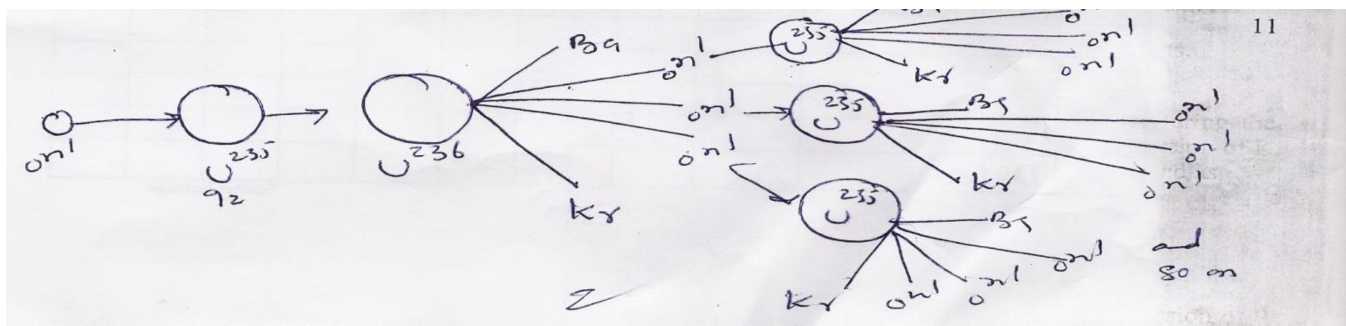


$${}_{92}U^{235} + {}_{o}n^{1} \longrightarrow {}_{56}Ba^{141} + {}_{36}Kr^{92} + 3{}_{o}n^{1} + \text{Energy}$$

Now, the three secondary neutrons produced cause the fission of 3 more U – atoms and produce

3 x 3 = 9 neutrons and a lot of energy is produced. These 9 neutrons then cause a further fission of 9 more U – atoms and produce 9 x 3 = 27 more neutrons and still greater amount of energy. Thus a continuous reaction called chain reaction would start and a huge amount of energy will be released in a short time (i.e., a few micro seconds). This chain reaction is shown in fig.

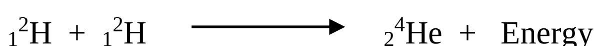
The uranium reaction was first used successfully to produce heat energy in a large scale by an Italian Physicist Enrico Ferni in 1942. Atom bomb was, however, manufacture during the World War II where this energy of nucleus was used as an explosive.



Q **Define nuclear fusion with examples.**

Ans. Nuclear fusion is the phenomenon of fusing two or more lighter nuclei to form heavy nucleus. The mass of the product nucleus is slightly less than the sun of the masses of the lighter nuclei fusion together. The lost mass results in the release tremendous amount of energy in accordance with Einstein's mass energy relation. $E = mC^2$. For example when deuterium atoms are heated to a very high temperature and combined to form a heavy nucleus of helium, an enormous amount of energy is liberated. Fusion

$$_1^2H + _1^2H \longrightarrow _2^4He + \text{Energy}$$



Q **What are conditions required for fusion reaction to take place?**

Ans. The nuclear fusion takes place under the condition of very high temperature ($\approx 10^8$K) and pressure. This is necessary so that protons have enough K.E. and they can come closer than the range of nuclear forces, against *this* mutual electrostatic repulsion. For fusion against this force, they require very high energy ($\approx$ 0.1 Mev). These conditions all met within the interior of the sun and cannot be arranged easily in a laboratory.

Q **State advantages and disadvantages of nuclear fusion over nuclear fission process.**

Ans. The advantages of nuclear fusion over nuclear fission are as follows:-

(1) The amount of energy liberated in a nuclear fusion is much more than that liberated in a fission reaction.

(2) The products of fusion reaction are not radioactive and are harmless while as the products of a fission reaction are radioactive and harmful.

Disadvantages of fusion reaction over fission reaction.

(1) The biggest disadvantage of a nuclear fusion reaction is that it has not been possible to have a controlled fusion reaction so far.

Q **Distinguish between nuclear fission and nuclear fusion.**

Nuclear Fission	Nuclear Fusion
1. In it a heavy nucleus breaks up to form two lighter nuclei. 2. Initiation temperature is not very high. 3. It can be controlled. 4. The products are radioactive. 5. It is a chain reaction. 6. An enormous amount of energy is released.	1. Two lighter nuclei combine to form a heavy nucleus. 2. Initiation temperature is very high. (10^6c) 3. It is not easy to control 4. The products are not radioactive. 5. It is not a chain reaction. 6. Energy liberated is far more than nuclear fission.

ACIDS, BASES AND SALTS

Introduction: About 115 elements are known to us at present. These elements combine to form large number of compounds. These compounds can be classified on the basis of their colour, taste, state, solubility and magnetic properties. On the basis of their chemical properties, chemical compounds are divided into three main classes, acids, bases and salts.

Q#1 What are electrolytes?

Ans. The substances which produce free ions in solution when melted are called electrolytes. All ionic substances e.g. NaCl and highly polar compounds e.g. HCl when dissolved in water give free ions. So, all ionic substances and highly polar compounds are electrolytes.

Q#2 What are acids and bases?

Ans. Early attempts to classify electrolytes into acids and bases were based on certain characteristic properties. e.g., the substances having the following properties were considered acids.

1. Acids have sour taste.
2. Acids change the colour of litmus from blue to red.
3. Acids react with certain metals producing hydrogen gas.
4. Acids decompose carbonates and bicarbonates giving out carbon dioxide gas.
5. Acids neutralize bases to give salt and water.

On the other hand, the substances having the following properties were considered bases.

1. Bases have bitter taste.
2. Bases are slippery to touch.
3. Bases change the colour of litmus from red to blue.
4. Bases neutralize acids to form salt and water.

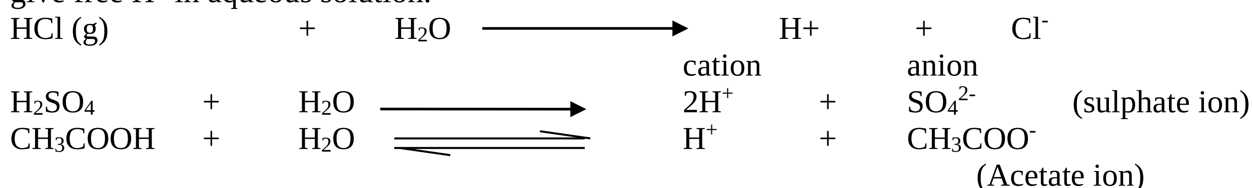
A systematic classification, however, began with the concept put forwarded by Svante Arrhenius in 1887.

Q#3 What is Arrhenius concept of acids and bases?

Ans. In 1887, a Swedish Chemist Svante Arrhenius put forward his concept of acids and bases.

According to him, an acid is a hydrogen containing compound which gives free hydrogen ions (H^+) when dissolved in water.

Thus, hydrogen chloride (HCl), acetic acid (CH_3COOH), sulphuric acid(H_2SO_4), carbonic acid(H_2CO_3), nitric acid (HNO_3) and phosphoric acid (H_3PO_4) are acids because all these compounds give free H^+ in aqueous solution.



$HCl (g) + H_2O \longrightarrow H+ + Cl^-$

cation anion

$H_2SO_4 + H_2O \longrightarrow 2H^+ + SO_4^{2-}$ (sulphate ion)

$CH_3COOH + H_2O \rightleftharpoons H^+ + CH_3COO^-$

(Acetate ion)

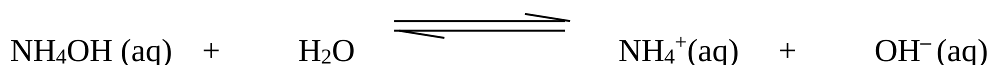
A base is a hydroxyl group containing compound which gives free hydroxide ions (OH^-) when dissolved in water.

Thus, according to Arrhenius concept, the compounds such as, sodium hydroxide (NaOH), potassium hydroxide (KOH), and ammonium hydroxide (NH_4OH) are bases, because these compounds give free OH^- ions in aqueous solutions.



$NaOH(s) + H_2O \longrightarrow Na^+(aq) + OH^-(aq)$

Sodium hydroxide



$NH_4OH (aq) + H_2O \rightleftharpoons NH_4^+(aq) + OH^-(aq)$

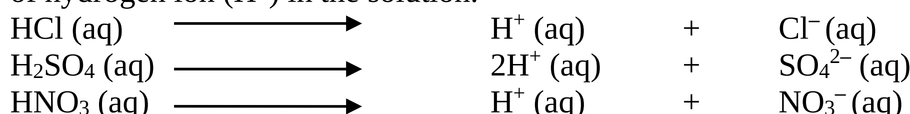
Limitations of Arrhenius concept:

1. This definition may be applied only for those reactions which are taking place in aqueous solution.
2. It does not cover other substances that do not contain H^+ and OH^- ions but can neutralize bases and acids respectively.
3. When an acid is put into water or solvent , H^+ ion exists as hydrated ion $H^+ .H_2O$ or H_3O^+ (hydronium ion) and not as free H^+ ion.

Q#4 What are strong and weak acids?

Ans. The acids which are almost completely ionized when dissolved in water are called strong acids.

Hydrochloric acid (HCl), sulphuric acid (H_2SO_4), nitric acid (HNO_3), perchloric acid ($HClO_4$) are strong acids. The solutions of strong acids in water are highly conducting due to high concentration of hydrogen ion (H^+) in the solution.



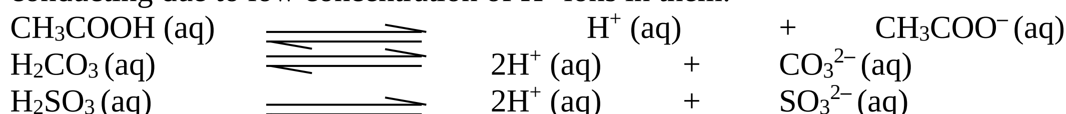
$HCl\ (aq) \longrightarrow H^+\ (aq) + Cl^-\ (aq)$

$H_2SO_4\ (aq) \longrightarrow 2H^+\ (aq) + SO_4^{2-}\ (aq)$

$HNO_3\ (aq) \longrightarrow H^+\ (aq) + NO_3^-\ (aq)$

The acids which are partially ionized when dissolved in water are called weak acids.

Acetic acid (or ethanoic acid, CH_3COOH), carbonic acid (H_2CO_3), hydrocyanic acid, sulphurous acid (H_2SO_3) and hydrogen sulphide are weak acids. The solutions of weak acids in water are poorly conducting due to low concentration of H^+ ions in them.



$CH_3COOH\ (aq) \rightleftharpoons H^+\ (aq) + CH_3COO^-\ (aq)$

$H_2CO_3\ (aq) \rightleftharpoons 2H^+\ (aq) + CO_3^{2-}\ (aq)$

$H_2SO_3\ (aq) \rightleftharpoons 2H^+\ (aq) + SO_3^{2-}\ (aq)$

Q#5 What are strong bases (or alkalies) and weak bases?

Ans. Bases which are almost completely dissociated / ionized are called strong bases. Strong bases are also called alkalies. Sodium hydroxide (NaOH) and potassium hydroxide (KOH) are strong bases. Solutions of strong bases are highly conducting because they contain high concentration of OH^- ions.

Bases which are partially dissociated /ionized in their aqueous solutions are called weak bases. Ammonium hydroxide (NH_4OH), calcium hydroxide ($Ca\ (OH)_2$) , magnesium hydroxide ($Mg(OH)_2$) are weak bases. Solutions of weak bases are very poorly conducting because they contain very low concentration of OH^- ions.

Q#6 What are indicators?

Ans. An indicator is a substance that gives different colours in different media. It is used to test the presence of an acid, base or salt. The three common indicators to test for acids and bases: litmus, methyl orange and phenolphthalein.

The most common indicator used for testing acids is litmus. Litmus is extracted from lichen that grows on the barks of a tree. It can either be dissolved in alcohol (ethanol) to give a purple solution or soaked into paper. It is of two types: blue litmus and red litmus.

If the red litmus changes to blue in the solution, then the solution is basic in nature.

If the blue litmus changes to red in the solution, then the solution is acidic in nature.

Moreover, phenolphthalein indicator is colourless in acidic solution but gives pink colour in basic solution.

Methyl orange gives red colour in acidic solution while as it gives yellow (orange) colour in basic solution.

Also, turmeric (Haldi) which is a natural indicator contains a yellow dye. It turns red in basic solution.

The red cabbage which is also a natural indicator is red in colour. It remains red in acidic solution but turns green on adding to basic solutions.

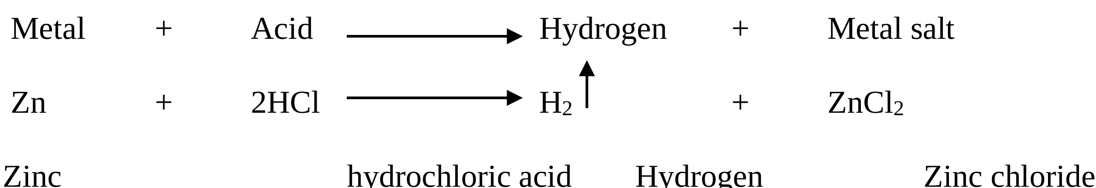
Q#7 Write down the physical and chemical properties of acids.

Ans. **Physical properties of acids:**

1. Acids have a sour taste.
2. Acids show colour changes with indicators.
3. Acid solutions conduct electricity.
4. Acids are corrosive in nature.

Chemical properties of acids:

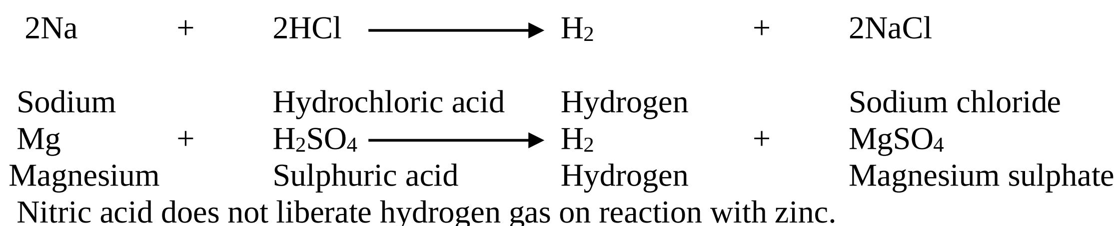
1. **<u>Action with metals</u>**: Acids react with certain metals (except Hg, Cu and Ag) produce hydrogen gas and corresponding metal salt.



Metal + Acid $\longrightarrow$ Hydrogen + Metal salt

$Zn + 2HCl \longrightarrow H_2\uparrow + ZnCl_2$

Zinc hydrochloric acid Hydrogen Zinc chloride



$2Na + 2HCl \longrightarrow H_2 + 2NaCl$

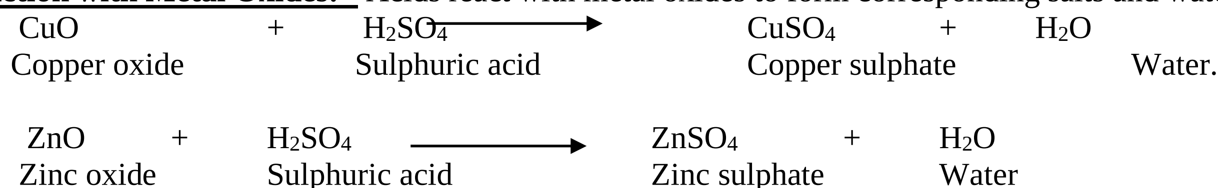
Sodium Hydrochloric acid Hydrogen Sodium chloride

$Mg + H_2SO_4 \longrightarrow H_2 + MgSO_4$

Magnesium Sulphuric acid Hydrogen Magnesium sulphate

Nitric acid does not liberate hydrogen gas on reaction with zinc.

2. **<u>Action with Metal Oxides: -</u>** Acids react with metal oxides to form corresponding salts and water.



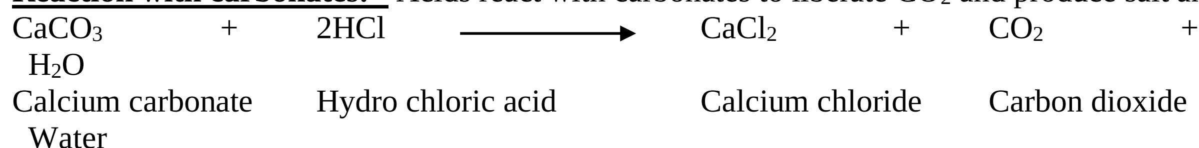
$CuO + H_2SO_4 \longrightarrow CuSO_4 + H_2O$

Copper oxide Sulphuric acid Copper sulphate Water.

$ZnO + H_2SO_4 \longrightarrow ZnSO_4 + H_2O$

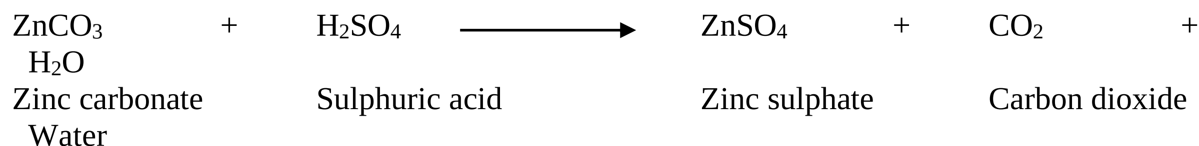
Zinc oxide Sulphuric acid Zinc sulphate Water

3. **<u>Reaction with carbonates: -</u>** Acids react with carbonates to liberate CO_2 and produce salt and water.



$CaCO_3 + 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O$

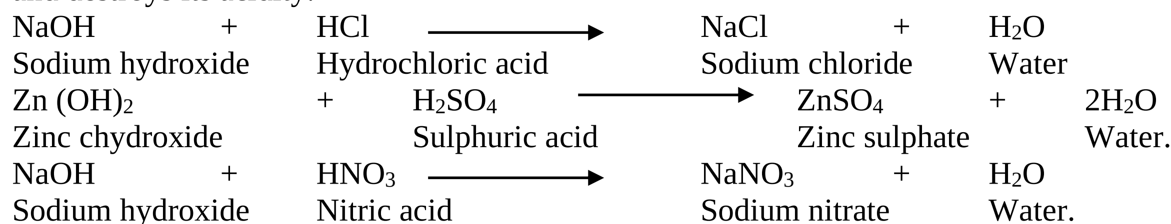
Calcium carbonate Hydro chloric acid Calcium chloride Carbon dioxide Water



$ZnCO_3 + H_2SO_4 \longrightarrow ZnSO_4 + CO_2 + H_2O$

Zinc carbonate Sulphuric acid Zinc sulphate Carbon dioxide Water

4. **<u>Reaction with bases (or alkalies):-</u>** Acids react with bases to form corresponding salt and water. This reaction is called neutralization reaction because the base when treated with acid neutralizes it and destroys its acidity.



$NaOH + HCl \longrightarrow NaCl + H_2O$

Sodium hydroxide Hydrochloric acid Sodium chloride Water

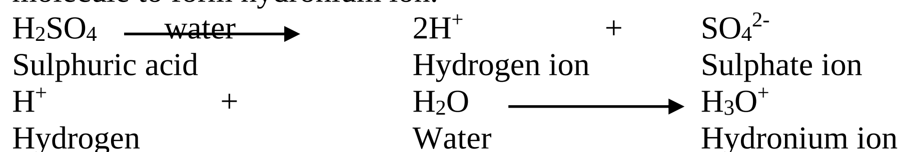
$Zn(OH)_2 + H_2SO_4 \longrightarrow ZnSO_4 + 2H_2O$

Zinc chydroxide Sulphuric acid Zinc sulphate Water.

$NaOH + HNO_3 \longrightarrow NaNO_3 + H_2O$

Sodium hydroxide Nitric acid Sodium nitrate Water.

5. **Action with water**:- When acids dissolve in water, the hydrogen ion combine with the water molecule to form hydronium ion.



H_2SO_4 —water→ $2H^+$ + SO_4^{2-}
Sulphuric acid   Hydrogen ion   Sulphate ion

H^+ + H_2O → H_3O^+
Hydrogen   Water   Hydronium ion

Q#8 What is basicity of acids?

Ans. Basicity means the number of hydrogen ions in one molecule of acid e.g. HCl has one replaceable hydrogen ion, hence, its basicity is one and is called monobasic acid. Similarly, the basicity of H_2SO_4 and H_2SO_3 is two and are called dibasic acids. Whereas, phosphoric acid (H_3PO_4) has three replaceable hydrogen ions and is called tribasic acid.

Q#9 Write down the uses of acids.

Ans Acids like HCl, H_2SO_4 and HNO_3 are used as reagents in laboratories and in industries for various purposes. Some of the uses of these acids are listed below:

Nitric acid:

1. It is used to make fertilizers like ammonium nitrate, calcium ammonium nitrate etc.
2. It is used to make explosive like TNT (Trinitrotoluene), nitro-glycerine etc.
3. It is also used in the purification of precious metals like gold and silver.

Sulphuric acid (king of chemicals)

1. It is used to make fertilizers like, ammonium sulphate , superphosphate etc.
2. It is used in the paints, plastics, drugs and detergents.
3. It is used in car batteries.
4. It is used as a dehydrating agent in chemical reactions.
5. It is also used in the petroleum refining industry.

Hydrochloric acid

1. It is used in the purification of common salt.
2. It is used in textile industries as a bleaching agent.
3. It is used in the manufacture of glue, used as catalyst in the preparation of glucose from starch.
4. It is used as a cleaning agent in galvanization mixtures.
5. It is used to make aqua regia. Aqua regia is a 1-3 mixture of concentrated nitric acid, and concentrated hydrochloric acid. It is used to dissolve noble metals like gold and platinum.

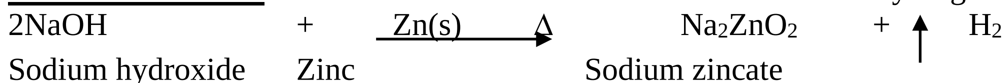
Q#10 Write down the physical and chemical properties of bases.

Ans. **Physical properties**

1. Bases have unpleasant and bitter taste.
2. Bases and alkalies are soapy to touch.
3. Bases turn red litmus to blue, methyl orange to yellow and phenolphthalein to pink.
4. Bases conduct electricity in solution(they are electrolytes)

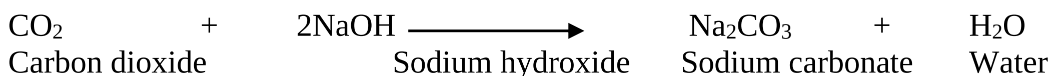
Chemical properties:

1. **Action with metals**: Bases react with some metals to form salt and hydrogen gas.



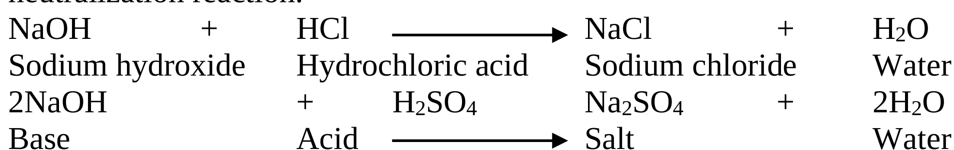
$2NaOH$ + $Zn(s)$ —Δ→ Na_2ZnO_2 + H_2↑
Sodium hydroxide   Zinc   Sodium zincate

2. **Action with the oxides of non metals**:- Bases from salt and water when they react with non metallic oxides.



CO_2 + $2NaOH$ → Na_2CO_3 + H_2O
Carbon dioxide   Sodium hydroxide   Sodium carbonate   Water

3. **Reaction with acids**:- All bases react with acids to form salt and water. This reaction is known as neutralization reaction.



$NaOH$ + HCl → $NaCl$ + H_2O
Sodium hydroxide   Hydrochloric acid   Sodium chloride   Water

$2NaOH$ + H_2SO_4 → Na_2SO_4 + $2H_2O$
Base   Acid   Salt   Water

Q#11 What is acidity of bases?

Ans. The number of replaceable hydroxyl (OH-) ions in a base is called the acidity of the base. For example, NaOH has one replicable hydroxyl ion, hence its acidity is one and is called monoacidic base. The acidity of $Ca(OH)_2$ is two , and is called diacidic base. The alumunium hydroxide Al $(OH)_3$ has three replicable hydroxyl ions , so its acidity is three and is called triacidic base.

Q#12 Write down the uses of bases.

Ans.1. Sodium hydroxide (caustic soda) is used in the manufacture of paper and pulp, rayon, medicine, chemicals and soaps. It is used for refining petroleum.

2. Calcium hydroxide (slaked line) is used to prepare plaster, bleaching powder, and to neutralize acid in water supplies.
3. Ammonium hydroxide is used as a reagent in laboratories, to remove grease from to glass panes to remove ink spots from clothes.
4. Magnesium hydroxide is used as an “antacid” to neutralize excess acid in the stomach and cure in digestion.
5. Sodium carbonate is used as washing soda and for softening hard water.
6. Sodium bicarbonate is used as baking soda in cooking food.
7. Potassium hydroxide (caustic potash) is used to conduct electricity between two electrodes.

Q#13 Give the difference between acids and bases.

Acids	**Bases**
1. Sour to taste. 2. Corrosive to skin. 3. Turn moist blue litmus red. 4. Give no colour with phenolphthalein. 5. Give red colour with methyl orange. 6. React with metals to give salt and hydrogen gas. 7. Contain hydrogen ion(H^+) 8. React with bases to give salt and water. 9. Examples; HCl, HNO_3,H_2SO_4.	1. Bitter to taste 2. Soapy to touch. 3. Turn moist red litmus blue. 4. Give pink colour with phenolphthalein. 5. Give yellow colour with methyl orange. 6. React with some metals (Zn, Al & tin) to give salt and hydrogen gas. 7. Contain hydroxide ion (OH^-) 8. React with acids to give salt and water. 9. Example; NaOH, KOH, $Ca(OH)_2$

Q#14 What is meant by pH of a solution?

Ans. In 1909, a Danish biochemist S.P. Sorensen proposed that the acidity of a solution be expressed in terms of a parameter called pH. The notation pH has been derived from the French word potenz de hydrogen (meaning power of hydrogen).

According to him, pH of a solution is defined as the negative logarithm (to base 10) of the hydrogen ion concentration in the solution.

Mathematically,

$$pH = -\log_{10}[H^+] = \log \frac{1}{[H^+]}$$

Or $[H^+] = 10^{-pH}$ mol L^{-1}

Thus, the pH of a solution is numerically equal to the negative power to which 10 must be raised in order to make

it equal to the molar concentration of H+ in the solution.

In aqueous solution, the $[H^+]$ usually varies from 10^0 mol/l to 10^{-14} mol/l at 298 K. Thus, pH values in aqueous solution usually vary from 0-14.

The nature of an aqueous solution depends upon the relative concentrations of $[H^+]$ and $[OH^-]$ ions in it. If,

$[H^+] = [OH^-]$, then the solution is neutral.
$[H^+] > [OH^-]$, then the solution is acidic.
$[H^+] < [OH^-]$, then the solution is alkaline or basic.
At 25^0 C (298K),
For pure water or a neutral solution
pH = 7.0 or $[H^+] = 10^{-7}$ g ion/L
For an acidic solution pH < 7.0 or $[H^+] > 10^{-7}$g ion/L
For an alkaline solution pH > 7.0 or $[H^+] < 10^{-7}$ g ion /L
Thus, at 298 K.
The pH values over the range 0-7 lie in the acidic side.
pH values over the range 7-14 lie in the alkaline side.
The pH of a solution can be measured by using reagents called pH indicators or pH papers. Instrument which is used for measuring the pH of a solution is known as pH meter.

Limitation of pH scale:

i) pH values of the solution do not give us immediate idea of the relative strength of the solution. A solution of pH = 1 has a hydrogen ion concentration 100 times that of a solution of pH = 3.

i) A solution of an acid having low concentration say 10^{-8}N cannot have pH= 8 as shown by pH formula but the actual pH value will be less than 7.

Q#15 What are the applications of pH?

Ans. The pH is plays an important role in many activities of our daily life. Some of the applications of pH are as under:

1. **In biological systems (i.e. plants and animals):** Most of the reactions taking place in our body are in the narrow pH range of 7-7.8. The survival of living organisms becomes difficult if pH falls below 7 or rises above 7.8.
   The plants grow best only when the soil has a specific range of pH. If the soil is too acidic or too basic, the plants grow badly and do not grow at all.
2. **In digestive system:** pH places a vital role in the digestion of food and other biochemical reactions inside the human/ animal body. pH of the gastric juice is 1-2 . Our stomach produces HCl (pH = 1.4) which helps in the digestion of food. The excess acid in the stomach causes in digestion which causes pain and irritation. The indigestion is cured by taking "antacid" like magnesium hydroxide and baking soda, which neutralizes the excess acid.
3. **Tooth decay caused by acids: -** If the pH in our mouth falls below 5.5 (acidic) , the dissolution of tooth decay begins. Lactic acid produced in the mouth due to degradation of sugar and food particles by the bacteria is also responsible for the tooth decay.
4. **Self defence of animals and plants through chemical warfare:-** When we are stung by an honeybee or yellow ant, we feel pain and irritation. This is due to the acid (formic acid i.e., methanoic acid) injected into our skin by the bee or the ant. To get the relief, we apply the solution of mild base like baking soda ($NaHCO_3$). Similarly, nettle plants have leaves with stinging hairs cause a lot of pain due to formic acid (HCOOH) (methanoic acid) injected by these leaves into the skin.
5. **Muscular fatigue caused by acid formation**:- It is interesting to know that the stiffness and pain that we feel after the exercise is due to the formation of an acid called lactic acid. When we do excessive physical labour, the
   aerobic metabolism is not sufficient to provide the required energy. Hence, muscles switch over to an anaerobic metabolism. This results in the production of lactic acid that accumulates in the muscles and we feel stiffness and pain, so muscular fatigue occurs due to the formation of lactic acid in muscles.

Q#16 What is a salt? Write the properties of salts.

Ans. A salt is a compound formed when the hydrogen ion of an acid is replaced by a metal. Salt is a compound composed of a metal combined with a non metal or non-metallic radical of an acid.

Preparation of salts:

i) By neutralization of acid and base:- When calculated quantities of an acid and a base are mixed together, a salt solution is formed.



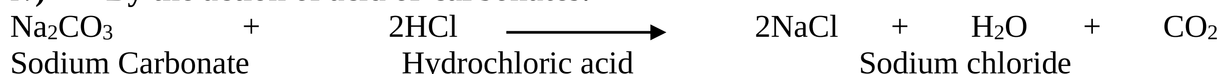
ii) By reaction of an acid with a metal: When metals treated with dilute HCl or dilute H_2SO_4, salt is formed. In these salts, the hydrogen atom of the acid is replaced by the metal.



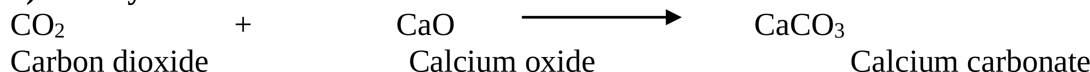
iii) By direct combination of two elements:



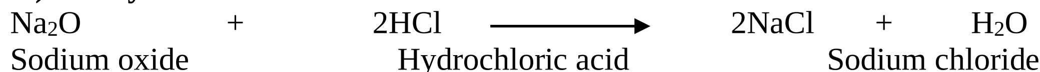
iv) By the action of acid or carbonates:-



v) By the reaction of some acidic oxides and basic oxides:-



vi) By the action of acid on metallic oxide:-



Salts:- Salts are regarded as compounds made up of positive and negative ions. The positive comes from a base while as negative part from an acid. Salts are ionic compounds. Salts may taste sour, bitter or neutral. Fused salts and aqueous solutions of salts conduct electricity and undergoes electrolysis. The properties of salts in aqueous solution are the properties of ions. The salts are generally crystalline solids.

1) **Simple Salts:-** The salts formed by the neutralization process i.e. interaction between acid and base, is termed as simple salt. The three types of simple salts are:

a) **Normal Salt**:-The salt formed by the loss of all possible protons (replaceable hydrogen atoms as H^+) are called normal salts. Such a salt does not contain either replaceable hydrogen or a hydroxyl group e.g. NaCl, $NaNO_3$, K_2SO_4.

b) **Acid Salt:-** Salt formed by incomplete neutralization of poly basic acids are called acid salt. Such salts still contain one or more replaceable hydrogen atoms. These salts when neutralized by base form normal salts e.g. $NaHCO_3$, $NaHSO_4$, NaH_2PO_4.

c) **Basic Salts:-** Salts formed by incomplete neutralization of poly acidic bases are called basic salts. Such salts contain one or more hydroxyl groups. These salts when neutralized by acid form normal salts e.g. Zn (OH) Cl , Mg(OH) Cl,

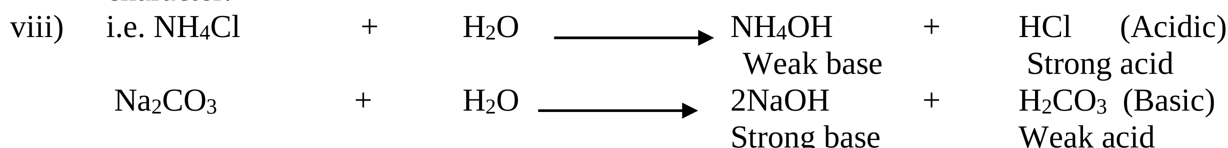
2) **Double Salts:-** The addition compound formed by the combination of two simple salts are termed as double salts. Such salts are stable in solid state only e.g. Ferrous ammonium Sulphate, $FeSO_4 (NH_4)_2SO_4 . 6H_2O$.

3) **Complex Salts**:- These are formed by combination of simple salt or molecular compound. These are stable in solid as well as in solutions e.g. $K_4Fe (CN_6)$, $CO (NH_3)_6 SO_4$

4) **Hydrated salt**:-A salt whose molecule contains a definite number of water molecules is called a hydrated salt. For example. $CuSO_4 . 5H_2O$. Copper sulphate (Blue vitriol)

Properties of Salts:

i) Salts are mostly solids.
ii) They have high M.P. and B.P.
iii) Salts are usually soluble in water. Except $HgCl_2$, AgCl, $BaSO_4$, CaSO4, $PbSO_4$. Carbonates and sulphides of K^+ , Na^+ and $NH4^+$
iv) Solution of salts in water conducts electricity.
v) Salts are ionic compounds.
vi) Coloured hydrated salts on heating lose their water of crystallization and become colourless (white).
vii) Salts on reacting with water (Hydrolysis) give a solution which shows either acidic or basic character.
viii) i.e.



$NH_4Cl + H_2O \longrightarrow NH_4OH + HCl$ (Acidic)
NH4OH: Weak base; HCl: Strong acid

$Na_2CO_3 + H_2O \longrightarrow 2NaOH + H_2CO_3$ (Basic)
2NaOH: Strong base; H2CO3: Weak acid

Q#17 What do you know by family of salts? Explain with examples.

Ans. The salts having the same positive ions or same negative ions are said to belong to a family of salts. For example, sodium chloride (NaCl) and sodium sulphate (Na_2SO_4) belong to the same family of salts called sodium salts as they contain the same positively charged ions, sodium ions, Na+.

Similarly sodium chloride (NaCl) and potassium chloride (KCl) belong to the same family of salts called chloride salts as they contain the same negatively charged ions, chloride ions, etc.

Q#18 What is common salt and how it is obtained from the sea water?

Ans. The common salt is a white powder whose chemical formula is sodium chloride (NaCl).

In coastal areas, sea water is trapped in shallow beds and evaporated in the sunlight. The white solid crystals are then processed in the industries, packed and sent to markets.

Q#19 Write few uses of common salt.

Ans. (i) Sodium chloride (common salt) is used in cooking food. It is required by our body for the working of nervous system and the production of HCl in the stomach for the digestion of food.
ii) It is used as a preservative in pickles, meat and fish.
iii) It is used for making a large number of useful chemicals in industry such as sodium hydroxide, sodium carbonate. Hydrochloric acid, hydrogen, chlorine and sodium metal.
iv) It is used in the manufacture of soap.
v) It is used to melt ice during winters on the roads.

Q#21 Give the preparation and uses of sodium hydroxide.

Ans. Sodium hydroxide is commonly known as caustic soda. Its chemical formula is NaOH.

Preparation of sodium hydroxide:- Sodium hydroxide is prepared by passing electricity through a concentrated solution of sodium chloride (brine)



$$2NaCl + 2H_2O \xrightarrow{\text{Electrolysis}} 2NaOH + Cl_2(g) + H_2(g)$$

Brine ... Sodium hydroxide

During electrolysis, chlorine gas is produced at the anode and hydrogen gas is produced at the cathode. Sodium hydroxide solution is formed near the cathode.

The process of electrolysis of NaCl solution is called chloro-alkali process because of the products formed chloro for chlorine and alkali for sodium hydroxide.

Uses of sodium hydroxide:-

1. Sodium hydroxide is used for making soaps and detergents.
2. Sodium hydroxide is used for making artificial textile fibres such as rayon in viscous process.
3. It is used in the manufacture of paper.
4. It is used in purifying bauxite ore from which aluminium metal is extracted.
5. It is used in oil refining and making dyes and bleaches.

Q#22 How is washing soda prepared? Write down the properties and uses of washing soda.

Ans. The chemical formula of washing soda is $Na_2CO_3 . 10H_2O$ (sodium carbonate decahydrate). Anhydrous sodium carbonate Na_2CO_3 is generally called soda ash.

Manufacture of sodium carbonate by Solvay's process:

Sodium carbonate is obtained on commercial scale by Solvay's process in the following three steps:

Step 1:- A cold and concentrated solution of sodium chloride (brine) is reacted with ammonia and carbon dioxide to obtain sodium bicarbonate.

$$NaCl(aq) + NH_3(g) + H_2O + CO_2 \longrightarrow NaHCO_3(s) + NH_4Cl$$

Ammonical brine (NaCl(aq) + NH_3(g) + H_2O); Baking soda ($NaHCO_3$)

Ammonium Chloride

The CO_2 required in this reaction is obtained by heating lime stone.

$$CaCO_3 \xrightarrow{heat} CaO + CO_2\uparrow$$

Lime stone Quick lime



Step 2:- Dry Baking soda is heated strongly to produce sodium carbonate.

$$2NaHCO_3 \xrightarrow{heat} Na_2CO_3 + H_2O\ (g) + CO_2\ (g)$$

Baking soda Soda ash



The CO_2 liberated in this step is sent for use in the carbonating tower (step1).

Step 3:- Washing soda ($Na_2CO_3. 10H_2O$) is obtained by crystallization from a saturated solution of soda ash (Na_2CO_3).

$$Na_2CO_3 + H_2O\ (l) \longrightarrow Na_2CO_3\ (aq) \xrightarrow{Crystallization} Na_2CO_3 . 10\ H_2O$$

Soda ash Washing soda.

Properties of washing soda:

1. Washing soda is a white crystalline solid.
2. It is readily dissolved in water.
3. The solution of washing soda in water is alkaline.
4. It has cleansing properties.
5. It gives soda ash on heating.
6. It is readily decomposed by acids due to the evolution of carbon dioxide.

Uses of washing soda: Some uses of washing soda are given below:

1. It is used for washing clothes (Laundry purposes).
2. It is used for softening hard water.
3. Sodium carbonate (soda ash) is used for the manufacture of detergents.
4. Sodium carbonate is used for the manufacture of many important compounds such as borax ($Na_2B_4O_7$).
5. Sodium carbonate is also used paper and paint industries.

Q#23 How is Baking soda prepared? Write down the properties and uses of Baking soda.

Ans. **Baking soda:-** The chemical name of Baking soda is sodium hydrogen carbonate or sodium bicarbonate . It is represented by the formula $NaHCO_3$.

Preparation of baking soda:- In laboratory, baking soda can be prepared by saturating a cold solution of sodium carbonate with CO_2.

$$Na_2CO_3 + CO_2 + H_2O \longrightarrow 2NaHCO_3$$

Sodium carbonate Baking soda (White crystals)

Baking soda being less soluble separates out as white crystals.

Properties of Baking Soda:

1. Baking soda is a white crystalline substance. It is sparingly soluble in water.
2. Aqueous solution of baking soda is mildly alkaline, due to the hydrolysis of HCO_3^- ion, but does

3. not give pink colour with phenolphthalein.



$NaHCO_3 \xrightarrow{\text{dissociation}} Na^+ + HCO_3^-$

Sodium bicarbonate



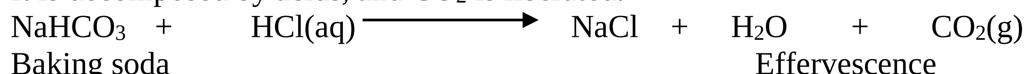
$HCO_3^- + H_2O \xrightarrow{\text{hydrolysis}} OH^- + H_2CO_3$

4. On heating, it decomposes to give sodium carbonate and CO_2 is liberated.



$2NaHCO_3 \xrightarrow{\text{heat}} Na_2CO_3 + H_2O + CO_2(g)$

4. It is decomposed by acids, and CO_2 is liberated.



$NaHCO_3 + HCl(aq) \longrightarrow NaCl + H_2O + CO_2(g)$

Baking soda — Effervescence

Uses of baking soda:-

(i) It is used for preparing baking powder and effervescent drinks.

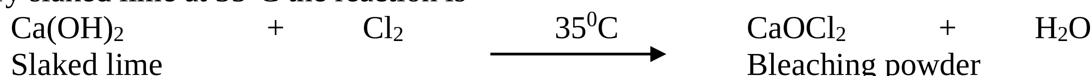
(ii) It is used as an antacid. It corrects the acidity in the stomach.

(iii) It is used in soda-acid type fire extinguishers.

Q#24 What is bleaching powder? How it is prepared? Write down the properties and uses of bleaching powder.

Ans. **Bleaching Powder:-** Chemically, bleaching powder is calcium oxychloride, $CaOCl_2$ or Ca (OCl)Cl. It is also called chloride of lime.

Preparation of bleaching powder:- Bleaching powder is manufactured by the action of chlorine on dry slaked lime at 35^0C the reaction is



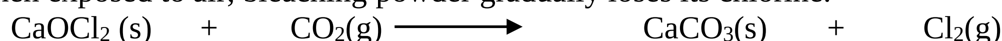
$Ca(OH)_2 + Cl_2 \xrightarrow{35^0C} CaOCl_2 + H_2O$

Slaked lime — Bleaching powder

manufacture of bleaching powder is generally carried out in the Hasanclever's plant.

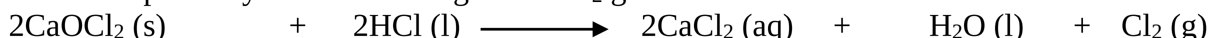
<u>Properties of bleaching powder:</u>

1. Bleaching powder is a yellowish- white powder which strongly smells of chlorine.
2. It is soluble in cold water the unreacted lime present in it, however, remains undissolved.
3. When exposed to air, bleaching powder gradually loses its chlorine.



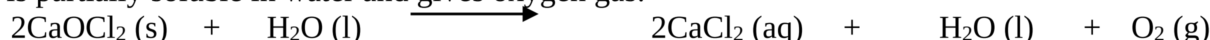
$CaOCl_2\,(s) + CO_2(g) \longrightarrow CaCO_3(s) + Cl_2(g)$

4. It is decomposed by dilute acids to give off Cl_2 gas.



$2CaOCl_2\,(s) + 2HCl\,(l) \longrightarrow 2CaCl_2\,(aq) + H_2O\,(l) + Cl_2\,(g)$

5. It is partially soluble in water and gives oxygen gas:



$2CaOCl_2\,(s) + H_2O\,(l) \longrightarrow 2CaCl_2\,(aq) + H_2O\,(l) + O_2\,(g)$

<u>Uses of Bleaching Powder:-</u>

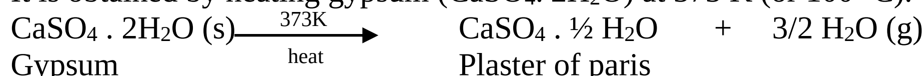
1. It is used for bleaching cotton fibre in textile industry and wood pulp in paper industry.
2. It is used as a disinfectant and germicide.
3. It is used to sterilize drinking water.
4. It is used to manufacture chloroform ($CHCl_3$).
5. It is used as an oxidizing agent.

Q#25 What is plaster of paris ? How it is prepared? Write down the properties and uses of plaster of paris.

Ans. Plaster of paris is hemi-hydrate of calcium sulphate.Its molecular formula is $CaSO_4$. ½ H_2O or $(CaSO_4)_2$. H_2O.

Preparation of plaster of paris:-

It is obtained by heating gypsum ($CaSO_4$. $2H_2O$) at 373 K (or 100^0 C).



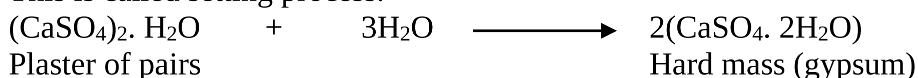
$CaSO_4 \cdot 2H_2O\,(s) \xrightarrow[\text{heat}]{373K} CaSO_4 \cdot \frac{1}{2} H_2O + 3/2\, H_2O\,(g)$

Gypsum — Plaster of paris

During its preparation, temperature should be controlled carefully. Otherwise, anhydrous calcium sulphate ($CaSO_4$) will be formed. Anhydrous $CaSO_4$ does not set into hard mass when mixed with water.

Properties of Plaster of Pairs:

1. Plaster of paris is a white odourless powder.
2. When mixed with water (50 % by mass), it sets to a hard mass within 10 minutes and evolves heat. This is called setting process.



$(CaSO_4)_2 . H_2O$ + $3H_2O$ ⟶ $2(CaSO_4 . 2H_2O)$

Plaster of pairs — Hard mass (gypsum)

Plaster of Pairs:

Uses

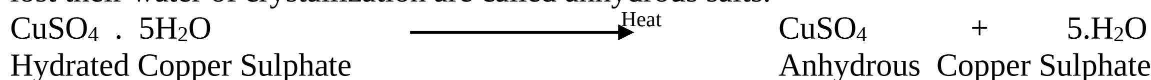
1. It is used for sealing air gaps.
2. It is used for making casts for statues, toys and decorative objects.
3. It is used for plastering the fractured bones to keep the joints in a fixed position.
4. It is used for making blackboard chalks.
5. It is used as a fire-proofing material.
6. It is used for making ornamental designs on the ceilings of houses and other buildings.

Q#26 What do you mean by hydrated and unhydrated salts ? Give examples.

Ans. **Hydrated Salt:-** A salt whose molecule contains a definite number of water molecules is called a hydrated salt For example, copper sulphate contains five water molecules and hence written as $CuSO_4 . 5H_2O$. It is called copper sulphate pentahydrate.

The water of crystalisation gives the crystals of the salts their 'shape' and in some cases, imparts them colour. Thus, $CuSO_4 .5H_2O$ is blue in colour, $FeSO_4 . 7H_2O$ is white in colour and $CaSO_4 .2H_2O$ is white in colour.

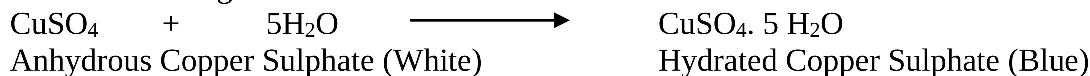
Unhydrated Salts: The salts lose water molecules when heated strongly. Thus, the salts which have lost their water of crystallization are called anhydrous salts.



$CuSO_4 . 5H_2O$ —Heat⟶ $CuSO_4$ + $5.H_2O$

Hydrated Copper Sulphate — Anhydrous Copper Sulphate

The dehydration of copper sulphate crystals is a reversible process. Thus anhydrous copper sulphate turns blue adding water.



$CuSO_4$ + $5H_2O$ ⟶ $CuSO_4 . 5 H_2O$

Anhydrous Copper Sulphate (White) — Hydrated Copper Sulphate (Blue)

Some of the commonly available hydrated salts are given in the following table:

Salts	**Common Names**	**Formula**
Copper sulphate	Blue vitriol	$CuSO_4 . 5H_2O$
Magnesium sulphate	Epsom salt	$MgSO_4 . 7H_2O$
Sodium carbonate	Washing soda	$Na_2CO_3 . 10H_2O$
Ferrous sulphate	Green vitriol	$FeSO_4 . 7H_2O$
Sodium sulphate	Glauber's salt	$Na_2SO_4 . 10H_2O$
Calcium chloride	Calcium chloride	$CaCl_2 . 2H_2O$
Calcium sulphate	Gypsum	$Ca(SO_4)_2 .H_2O$
Calcium sulphate	Plaster of Paris	$Ca(SO_4)_2 . H_2O$

Textbook Questions

Q#1 You have been provided with three test tubes. One of them contains distilled water and the other two contains an acidic solution and a basic solution respectively. If you are given only red litmus paper how will you identify the contents of each test tube?

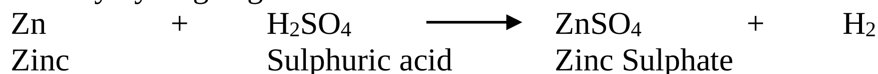
Ans. Put the red litmus paper in all the test tubes, one by one. The solution which turns red litmus to blue will be a basic solution. The blue litmus paper formed here is now put in the remaining two test tubes, one by one. The solution which turns the blue litmus paper to red will be the acidic solution while as the solution which has no effect on any litmus paper will be neutral and hence it will be distilled water.

Q#2 Why should curd and sour substances not be kept in brass and copper vessels?

Ans. When acidic substances like curd or other sour substances are kept in brass and copper vessels, they react with the metallic vessels to form toxic compounds and make the food stuff not fit for consumption. So, these substances should not be kept in brass and copper vessels.

Q#3 Which gas is usually liberated when an acid reacts with a metal ? Illustrate with an example. How will you test for the presence of this gas?

Ans. Usually hydrogen gas is liberated when a metal reacts with an acid e.g.



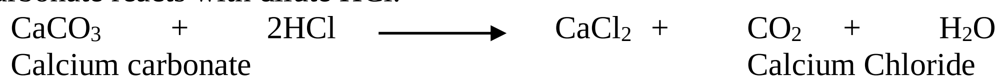
$Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$

Zinc Sulphuric acid Zinc Sulphate

Presence of hydrogen gas can be tested by passing the gas through the soap solution and then bringing a burning candle near the soap bubble filled with the gas. The soap bubbles burst and the hydrogen gas burns with a pop sound.

Q#4 Metal compound A reacts with dilute hydrochloric acid to produce effervescence. The gas evolved extinguishes a burning candle. Write a balanced chemical equation for the reaction if one of the compounds formed is calcium chloride?

Ans. If the gas extinguishes a burning candle, then the gas is CO_2 which is formed which calcium carbonate reacts with dilute HCl.



$CaCO_3 + 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O$

Calcium carbonate Calcium Chloride

Q#5 Why do HCl, HNO_3. etc., show acidic characters in aqueous solutions while solutions of compounds like alcohol and glucose do not show acidic character?

Ans. HCl, HNO_3 etc show acidic characters in aqueous solution as they can ionize and liberate H^+ ions. Compounds like glucose and alcohol do not ionize in the aqueous solution to give H^+ ions. Hence, they do not show acidic character.

Q#6 Why does an aqueous solution of acid conduct electricity?

Ans. The aqueous solution of an acid conducts electricity due to the presence of charged particles (ions) in it. For example, when HCl is dissolved in water, then its solution contains hydrogen ions H^+ (aq) and chloride ions, Cl^- (aq). These ions can carry electric current.



$HCl \longrightarrow H^+ + Cl^-$

Q#7 Why does dry HCl gas not change the colour of the dry litmus paper?

Ans. Dry HCl gas does not change the colour of dry litmus paper because it has no hydrogen ions H^+ ions in it. However, when HCl gas is dissolved in water it forms hydrogen ions and hence changes the colour of the litmus paper.

Q#8 While diluting an acid. Why is it recommended that the acid should be added to water and not water to the acid?

Ans. Dilution of concentrated acid with water is an exothermic process. If water is added to concentrated acid to dilute it, then a large amount of heat is evolved it, then a large amount of heat is evolved at once. This heat changes some of the water to steam explosively which can splash the acid on our face or clothes and cause acid burns.

Thus dilution of an acid should be done by adding acid into water where the heat is evolved gradually and easily absorbed by the large amount of water.

Q#9 How is the concentration of hydronium ions (H_3O) affected when a solution of an acid is diluted?

Ans. The concentration of hydronium ions [H_3O^+] decreases, when a solution of an acid is diluted.

Q#10 How is the concentration of hydroxide ions (OH^-) affected when excess base is dissolved in a solution of sodium hydroxide?Ans. The concentration of hydroxide ions [OH^-] increases. When excess base is dissolved in a solution of sodium hydroxide NaOH.Q#11 You have two solutions, A and B. The pH of the solution A is 6 and pH of the solution B is 8. Which has more hydrogen ion concentration? Which of this is acidic and which one is basic?

Ans. Since the pH of a solution is inversely proportional to its hydrogen ion concentration. Thus the solution having lower pH will have more H^+ concentration and hence having higher acidity. Thus, solution A (having a lower pH of 6) will have more H^+ concentration.

So, solution A is acidic and solution B is basic.

Q#12 What effect does the concentration of H^+ (aq) ions have on the nature of the solution?
Ans. If the concentration of H^+ (aq) ions increases, the solution becomes more acidic.
Q#13 Do basic solutions also have H^+ (aq) ions? If yes, then why are these basic?
Ans. Yes, basic solutions having hydrogen ion in them which come from the ionization of water but the concentration of OH^- ion concentration is greater than that of H^+ ion concentration, that is why they are called basic.
Q#14 Under what soil condition do you think a farmer would treat the soil of his fields with quicklime (calcium oxide) or slakedlime (calcium hydroxide) or chalk (calcium carbonate)?
Ans. If the soil is too acidic, then it is treated with quick lime (CaO), slaked lime ($Ca(OH)_2$) or chalk ($CaCO_3$). All these materials are bases and hence react with the excess acid present in soil and reduce its acidity. Thus, a farmer should add lime on his fields.
Q#15 What is the common name of the compound $CaOCl_2$?
An. Bleaching powder.
Q#16 Name the substance which on treatment with chlorine yields bleaching powder?
Ans. Calcium hydroxide [$Ca(OH)_2$]
Q#17 Name the sodium compound which is used for softening hard water?
Ans. Sodium Carbonate (washing soda)
Q#18 What will happen if a solution of sodium hydrogen carbonate is heated? Give the equation of the reaction involved.
Ans Sodium Carbonate is formed

$$2NaHCO_3 \xrightarrow{heat} Na_2CO_3 + H_2O + CO_2$$

Q#19 Write an equation to show the reaction between Plaster of Paris and water?
Ans.

$$(CaSO_4)_2.\,H_2O + 3H_2O \longrightarrow 2(CaSO_4.\,2H_2O)$$

Plaster of Paris — Gypsum

Q#21 A solution turns red litmus blue; its pH is likely to be
a) 1 b) 4 c) 5 d) 10
Ans. The solution which turns red litmus blue is basic. Hence, its pH should be greater than 7 therefore; pH is likely to be 10
Q#21 A solution reacts with crushed egg-shells to give a gas that turns lime-water milky. The solution contains
a) NaCl b) HCl c) LiCI d) KCl
Ans. HCl
Q#22 10 ml of a solution of NaOH is found to be completely neutralized by 8 ml of a given solution of HCl. If we take 20 ml of the same solution of NaOH, the amount HCl solution (the same solution as before) required to neutralize it will be
a) 4 ml b) 8 ml c) 12 ml d) 16 ml
Ans. 16ml
Q#23 Which one of the following types of medicines is used for treating indigestion?
a) Antibiotic b) Analgesic c) Antacid d) Antiseptic
Ans. Antacid
Q#24 Write word equations and then balanced equations for the reaction taking place when-
a) Dilute sulphuric acid reacts with zinc granules.
b) Dilute hydrochloric acid reacts with magnesium ribbon.
c) Dilute sulphuric acid reacts with aluminium powder.
d) Dilute hydrochloric acid reacts with iron filings.
Ans.
a) $Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$
b) $Mg + 2HCl \longrightarrow MgCl_2 + H_2$
c) $2Al + 3H_2SO_4 \longrightarrow Al_2(SO_4)_3 + 3H_2$
d) $Fe + 2HCl \longrightarrow FeCl_2 + H_2$
Q#25 Compounds such as alcohols and glucose also contain hydrogen but are not categorized as acids. Describe an activity to prove it.

Ans. The aqueous solution of glucose and alcohol do not show acidic character because their hydrogen does not separate out as hydrogen ions [H^+(aq)ions] on dissolving in water.

Activity:- Take glucose solution in the beaker. Fix two iron metals on a rubber cork and place the cork in the beaker. Connect the nails of the two terminals of a 6v battery through a switch. Switch on the current. The bulb does not glow; this shows that glucose solution does not conduct electricity. In the same way, alcohol also does not conduct electricity.

Q#26 Why does distilled water not conduct electricity, whereas rain water does?

Ans. Distilled water does not conduct electricity because it does not contain any ionic compound (like acids, bases or salts) dissolved in it. On the other hand, rain water contains carbonic acid, sulphuric acid, nitric acid etc which provide ions to rain water and hence rain water conducts electricity.

Q#27 Why do acids not show acidic behaviour in the absence of water?

Ans. The acidic behaviour of acids is due to the presence of hydrogen ions, H^+ (aq) ions, in them. The acids produce hydrogen ions only in the presence of water. So, in the absence of water, a substance will not form hydrogen ions and hence will not show its acidic behaviour.

Q#28 Five solutions A, B,C,D and E when tested with universal indicator showed pH as 4 , 1, 11, 7 and 9, respectively. Which solution is

a) Neutral b) Strongly alkaline? c) Strongly/acidic? D) Weakly acidic?

Arrange the pH in increasing order of hydrogen-ion concentration.

Ans.
- i) Solution D (pH = 7) is neutral
- ii) Solution C (pH = 11) is strongly alkaline
- iii) Solution B (pH = 1) is strongly acidic.
- iv) Solution A (pH = 4) is weakly acidic.
- v) Solution E (pH = 9) is weakly alkaline.

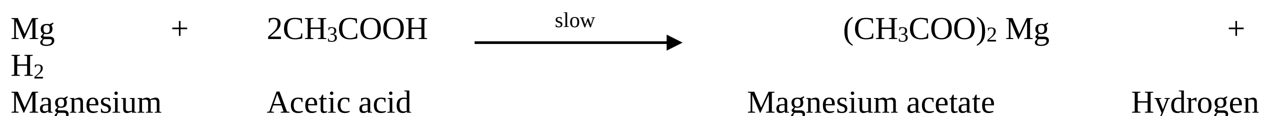
Q#29 Equal lengths of magnesium ribbons are taken in test tubes A and B. Hydrochloric acid (HCl) is added to test tube A, while acetic acid (CH_3COOH) is added to test tube B. In which test tube will the fizzing occur more vigorously and why?

Ans. More vigorous reaction will occur in test tube A containing HCl, because HCl is more stronger than Acetic acid. The reactions are given below



Mg + 2HCl → $MgCl_2$ + H_2

Magnesium Hydrochloric acid Magnesium chloride Hydrogen



Mg + $2CH_3COOH$ → $(CH_3COO)_2$ Mg + H_2

Magnesium Acetic acid Magnesium acetate Hydrogen

Q#30 Fresh milk has a pH of 6. How do you think the pH will change as it turns into curd ? Explain your answer.

Ans. When milk changes into curd, it will become more acidic and hence its pH will decrease, because pH is inversely proportional to the acidic character of the solution.

Q#31 A milkman adds a very small amount of baking soda to fresh milk.
- a) Why does he shift the pH of the fresh milk from 6 to slightly alkaline?
- b) Why does this milk take a long time to set as curd?

Ans.a) Milk is made slightly alkaline by adding small amount of baking soda, so that it may not get sour easily due to the formation of lactic acid in it.

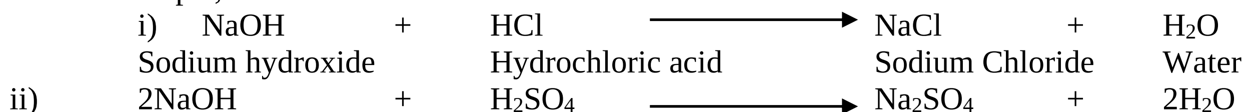
b) The alkaline milk takes a longer time to set into curd because the lactic acid being formed has to first neutralize the alkali present in it.

Q#32 Plaster of Paris should be stored in a moisture-proof container. Explain why?

Ans. Plaster of Paris should be stored in a moisture-proof container because plaster of Paris absorbs moisture and sets into a hard mass, which makes the Plaster of Paris useless after some time.

Q#33 What is a neutralization reaction ? Give two examples.

Ans. When an acid reacts with a base to form salt and water, it is called neutralization reaction. For example,



i) $NaOH + HCl \rightarrow NaCl + H_2O$

Sodium hydroxide + Hydrochloric acid → Sodium Chloride + Water

ii) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

Q#34 Give two important uses of washing soda and baking soda?

Ans. **Uses of washing soda:**

1. It is used for washing clothes (Laundry purposes).
2. It is used for softening hard water.
3. Sodium carbonate (soda ash) is used for the manufacture of detergents.
4. Sodium carbonate is used for the manufacture of many important compounds such as borax ($Na_2B_4O_7$), hypo ($Na_2S_2O_3 . 5H_2O$) etc.
5. Sodium carbonate is also used paper and point industries.

Uses of baking soda:-

(i) It is used for preparing baking powder and effervescent drinks.

(ii) It is used as an antacid. It corrects the acidity in the stomach.

(iii)It is used in soda-acid type fire extinguishers.

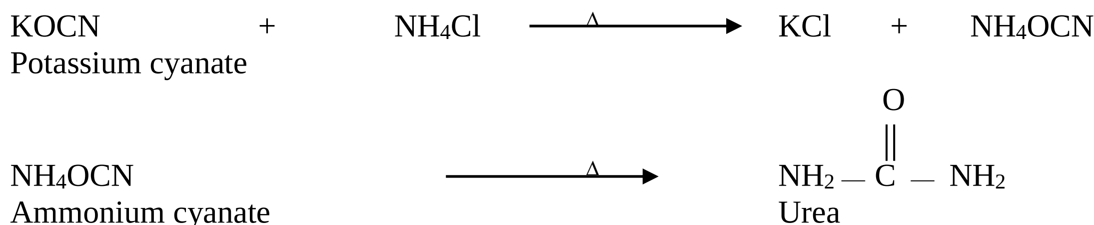
Carbon And Its Compounds

Chemistry

Introduction:-There are two main classes of chemical compounds, inorganic and organic. More than a century
ago, the compounds which were of mineral origin were known as inorganic and those of vegetable or animal origin were known as organic. For example, table salt, marble and CO_2 are inorganic, whereas acetic acid, alcohol, tartaric acid, sucrose were organic.

It was assumed that the organic compounds could be produced only by living matter, as living matter was thought to possess a vital force.

In 1828, the German Chemist Friedrich Wohler heated ammonium cyanate, derived from inorganic substance, and obtained the organic compound urea.



$KOCN + NH_4Cl \xrightarrow{\Delta} KCl + NH_4OCN$

Potassium cyanate

$NH_4OCN \xrightarrow{\Delta} NH_2 - \overset{\overset{O}{||}}{C} - NH_2$

Ammonium cyanate → Urea

Thus in 1850, the vital force theory was finally disproved.

Organic chemistry:- Organic chemistry is defined as the study of carbon compounds. However, there are several exceptions:
Carbon monoxide (CO), carbonates (Na_2CO_3),Carbon dioxide(CO_2), Bicarbonates ($NaHCO_3$),Carbides (CaC_2), carbon disulphide (CS2), etc.

Q#1 What are organic and inorganic compounds of carbon?

Ans. **Organic Compounds**: are defined as compounds or carbon containing usually hydrogen and one or more additiona1 elements oxygen, nitrogen, sulphur, halogens etc. and the branch or Chemistry which deals with the study of organic compounds is called organic Chemistry.

Inorganic Compounds: Compounds in which carbon is linked to other atoms such as oxygen, halogens, metals etc. and do not have C-C-bonds are called inorganic compounds of carbon.

Q#2 Differentiate between Organic and Inorganic Compounds.

Organic Compounds	Inorganic Compounds
1. They are generally covalent in nature.	They are ionic compounds.
2. Their reaction is molecular.	Their reaction is ionic.
3. They show isomerism.	They do not show isomerism.
4. They have low M.P and B.P and they decompose on heating.	They have high M.P. and B. P. and they do not decompose on heating.
5. The usually do not dissolve in water.	They dissolve in water.
6. The total number of Organic Compounds exceeds five million.	The total number of inorganic compounds is 50,000 approximately.
7. They have high molecular mass and complex structures.	They have low molecular mass and simple structures.
8. Aqueous solutions of organic compounds possess low electrical conductivity.	Aqueous solutions of Inorganic Compounds high electrical conductivity.
9. They generally dissolve in organic solvents like ether, alcohol, benzene and chloroform.	They generally do not dissolve Inorganic solvents.
10. They are highly combustible.	They are non-combustible except H_2, Co etc.
11. Certain classes possess characteristic colours and odours.	They are generally colourless and odourless.

Q#3 How does carbon occur in nature?

Ans. Carbon is widely distributed in nature both in the Free State and in the combined state. In the Free State, it occurs as diamond Graphite and Buckminister fullerence In the combined state, it occurs in form of:

1. Carbonates i.e., Limestone ($CaCO_3$)
   Magnesite (Mg $C0_3$), dolomite ($CaCO_3$ $MgCO_3$), malachite [$CuCO_3$. Cu $(OH)_2$], Siderite ($FeCO_3$), Calamine ($ZnCO_3$)
2. Coal, petroleum and natural gas.
3. Proteins and fats.
4. CO_2 in the air.
5. All living things, plants and animals contain organic compounds.

Q#4 What is the position of carbon atom in the periodic table. Give its electronic configuration.

Ans. Carbon is a normal element having four electrons in the outer most shell of its atom. Since carbon has 4 electrons in the outermost shell of its atom, it has been placed in-group IV of the periodic table. Carbon is the first member of the group IV A of the periodic table, which includes Silicon, Germanium, Tin and Lead besides Carbon.

The electronic configuration of Carbon is $1S^2$, $2s^2$, $2p^2$ or [He], $2s^2$, $2p^2$ or K
L
2 4

It is a non metal but as the atomic number of group IV elements increases, they begin to show some properties of metals. For example Si and Ge are semiconductors whereas Sn and Pb are metals.

Q#5 What is allotropy? Give the allotropic forms of carbon.

Ans. When an element exists in two or more forms having different physical properties but identical chemical properties, it is called allotropy and the different forms are called allotropes, allotropic forms or allotropic modifications.

Carbon exists in two allotropic forms: -

i. Crystalline and ii. Amorphous or Microcrystalline forms of carbon iii.Buckminster fullerene

1. Crvstalline allotropic forms of carbon: -

Two naturally occurring allotropes of carbon having well defined crystal structures are: -

i. Diamond and ii. Graphite. Due to different structures they have different properties.

2. Amorphous or Microcrvstalline forms of carbon: -

The various amorphous forms of carbon are coal, coke, charcoal, bone, blood or animal charcoal lamp black, carbon black, gas carbon and petroleum coke.

Q#6 What is diamond? How diamonds occur? How diamonds are formed in nature? Give the properties and uses of diamond.

Ans. Diamond is the purest form of carbon. It is represented by the symbol C. It derives its name from Greek word diaphane meaning transparent.

Occurance: - They are found chiefly in South Africa, Congo, Angola and Brazil. The famous 'Kohinoor' diamond was found in Wajrakarur. Diamonds are described in terms of carats (l carat = 200mg).

How diamonds are formed: - They are formed from the carbon present in the upper mantle at a depth of over 150kms inside the Earth, under the conditions of high temperature (1500°c) and high pressure (70,000 atm). They are brought to the surface of the earth by Kimberlite rock. Diamonds can also se made artificially. They can be made when graphite is subjected to a high temperature (100000 atmospheres) and a very high temperature (about 3700^0C)

Properties of Diamond: -

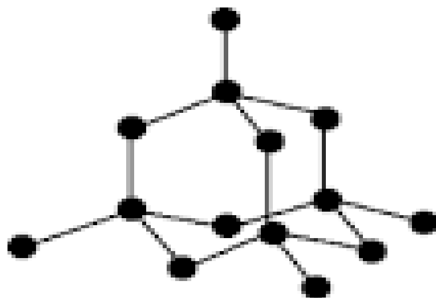
1. It is the purest form of carbon.
2. It is the hardest substance known.
3. It has very high melting point 3843k and high-density 3.5 g/cm3.
4. It is a bad conductor of electricity, but good conductor of heat.
5. It has a very high refractive index (2.5), it can reflect and refract light. Therefore, it is a transparent substance.
6. It is insoluble in all solvents.
7. It is a colourless solid.
8. If heated strongly without excess of air it changes to Graphite.

Uses Of Diamond:

1. It is used in Jewellary as precious stone.
2. It is used for cutting glass.
3. It is used in rock drilling equipments.
4. It is used for making highly accurate thermometers because of sensitivity to heat rays. 5. It is used for making dies for drawing thin wires from metals.
5. It is used for making dies for drawing thin wires from metals.
6. It is used for grinding hard materials.
7. It is used by eye-surgeon as a tool to remove cataract from eyes.
8. It is used for making protective windows for space satellites.

Q#7 Describe the structure of diamond.

Ans. A diamond crystal is giant molecule of C-atoms. Each carbon atom is linked to four other C-atoms by strong covalent bonds to form tetrahedral structure.



Q#8 What is graphite? How does it occur? How can it be prepared? Give the properties and uses of graphite.

Ans. Graphite is black and soft substance, which possess metallic lusture and has a soapy touch. Its symbol is c. It derives its name from the Greek word Graphein meaning to write.

Occurrence:- It is found in Orissa, Rajasthan, Bihar, J&K, Sri lanka, Andhra Pradesh, Karanatka, Canada, Tamil Nadu, and United State of America. Its occurrences is common because formation does not require extreme conditions like excessive heat and temperature.

Preparation:- It is prepared by Acheson's process by heating powdered Coke mixed with little sand and ferric Oxide to 3237k in an electric furnace.

Properties of graphite:

1. It is also the purest form of carbon (90-97%) of carbon)
2. It is soft and good lubricant.
3. It is dark grey having a metallic luster.
4. It is a good conductor of heat and electricity.
5. It density is 2.25gcm^{-3})

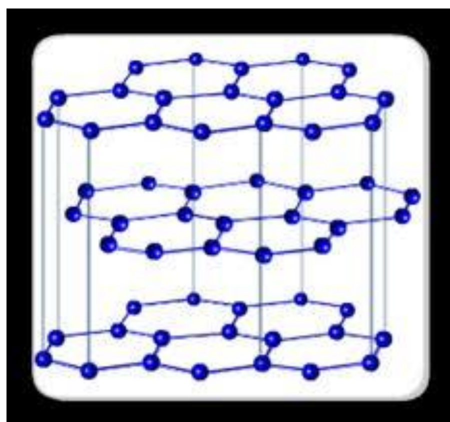
6. It is insoluble in water and organic solvents.
7. It can mark paper.
8. It burns on strong heating (700^0C) to form CO_2.

Uses of Graphite:

1. It is used as a lubricant in heavy industry.
2. It is used for making electrodes for dry cells.
3. It is used for making cores of lead pencils.
4. It is used for the manufacture of crucibles, which can withstand high temperature.
5. It is used as moderator in atomic reactors.
6. It is used in electrotyping and electroplating.
7. It is used as covering of plaster casts.
8. Its fibres are strong, so it is used to reinforce plastic.

Q#9 Describe the structure of graphite or arrangement of C-atoms in graphite.

Ans. Graphite consists of C-atoms or sheets of C-atoms. Each carbon atom is linked to three other C-atoms directly In the same plane by covalent bonds to form flat hexagonal rings. These rings constitute huge sheets or layers of atoms as shown in fig. The C-C bond length in rings is $1.42A^0$ while different sheets of C-atoms are held by weak Vander Waal's force at a distance of $3.4\ A^0$



Q#10 What is Buckminster fullerene? What are their uses in future?

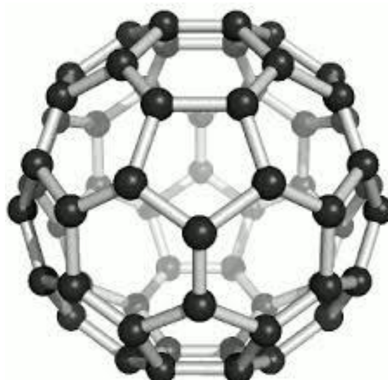
Ans. In 1985, scientists created a new allotrope of carbon element by heating graphite to extremely high temperature. This is called Buckminster fullerene. It is an allotrope of carbon containing clusters of 60 carbon atoms joined together to form spherical molecules. Its formula is C_{60}. Buckminster fullerene is a football shaped spherical molecule in which 60 carbon atoms are arranged in interlocking hexagonal and pentagonal rings of C—atoms. There are 20 hexagonal and 12 pentagonal rings of c-atoms in its single molecule. The structure of this allotrope resembles the frame work of dome shaped halls designed by American architect Buckminster fullerene for large international exhibitions.

Buckminster fullerene is a dark solid at room temperature. It is a spherical carbon molecule containing 60 carbon atoms joined together which was discovered in 1985. Other spherical molecules of carbon made up of 70, 90 and 120 carbon atoms have now been discovered . They are written as C_{70} , C_{90} and C_{120} respectively.

The fullerenes have been found to be present in interstellar clouds in outer space. They have also been found to exist in nature in the meteorite which had fallen in Germany and in ancient rocks which occur in New Zealand and Russia.

The researches which have been done so far has suggested that in future, fullerenes and their compounds may prove to be of great use as semiconductors, superconductors, lubricants, catalysts

electric wires and as fibres to reinforce plastic. Some of the compounds of fullerenes appear to be active against diseases like cancer and AIDS. This can lead to finding cure for cancer and AIDS.



Q#11 What are hydrocarbons? How are they have been classified.

Ans. The simplest organic compound containing carbon and hydrogen are called hydrocarbons.
Hydrocarbons are of two types
i. Saturated and ii. Unsaturated

<u>**Saturated hydrocarbons:**</u> are those in which all the carbon atoms are linked to one another by only single bonds. i.e. the carbon valences are fully satisfied. These compounds contain only C-C and C-H types of bonds. Since they are relatively inert towards most of the chemical reagents under ordinary conditions, they are called paraffin's (Latin parum-little affins-affinity) The IUPAC name for these compounds is alkanes and they are represented by a general formula C_nH_{2n+2} where
n = 1,2,3,4…

N.	Formula	Common Name	IUPAC Name
1	CH_4	Methane	Methane
2	C_2H_6	Ethane	Ethane
3	C_3H_8	Propane	Propane
4	C_4H_{10}	n- Butane	Butane
5	C_5H_{12}	n- pentane	Pentane
6	C_6H_{14}	n-Hexane	Hexane
7	C_7H_{16}	n-Heptane	Heptane
8	C_8H_{18}	n-Octane	Octane
9	C_9H_{20}	n- Nonane	Nonane
10	$C_{10}H_{22}$	n-Decane	Decane

<u>**Unsaturated Hydrocarbons :**</u> A hydrocarbon in which the two c-atoms are connected by a "double bond" or a "triple bond" is called an unsaturated hydrocarbon. These are further classified into two types.
i. <u>Alkenes or Olefins (containing "double bond")</u>
ii. <u>Alkynes or Acetylenes ("triple bond")</u>

<u>Alkenes or Olefins: -</u> Unsaturated hydrocarbons containing C=C bond in their molecule are called alkenes. They are also called olefines (Latin, oleun = oil, ficare = to make) because their lower members form oily products on treatment with chlorine or bromine.
They are represented by a general formula $C_n H_{2n}$, where n=2,3,4...........

Names of alkenes:

1. Common name:- Alkane-ane+ylene= Alkylene.
2. IUPAC name: Alkane - ane+ene= alkene

The molecule formula, common name and IUP AC name of first six alkenes are –

N	Formula	Common Name	IUPAC Name
1	CH_2(Unstable)	Methylene	Methene
2	C_2H_4	Ethylene	Ethene
3	C_3H_6	Propylene	Propene
4	C_4H_8	Butylene	Butene
5	C_5H_{10}	Pentylene	Pentene
6	C_6H_{12}	Hexylene	Hexene

Alkynes or Acetylene

Unsaturated hydrocarbon containing a Carbon-Carbon triple bond are called alkynes. They are also called acetylenes after the name of the first member of this series called acetylene, HC≡CH, and a triple bond is often referred to as the acetylenic linkage.

They are represented by a general formula C_nH_{2n-2} , where n = 2,3,4 ...

Names of alkynes:

1. Common names: Acetylene and its alkyl derivatives.
2. IUPAC name: Alkane- ane+yne= Alkyne.

The common and IUPAC names of a few simple alkynes are given below :

N	Formula	Common name	IUP AC Name
2	C_2H_2	Acetylene	Ethyne
3	C_3H_4	Methyl-acetylene Or Allylene	Propyne
4	C_4H_8	Ethyl Acetylene	Butyne
5	C_5H_8	Propyl acetylene	Pentyne
6	C_6H_{10}	Butylacetylene	Hexyne

Alkyl group :- The group formed by the removal of one H-atom from an alkane molecule is called an alkyl group. e.g methyl group CH_3 and Ethyl group C_2H_{5-}. They are formed by the removal of one H-atom from methane and ethane.

The general formula of alkyl group is $C_n H_{2n+1}$. Thus alkane-ane + yl = alkyl

Alkane	Alkyl group	Common Name
Methane CH_4	CH_3___	Methyl
Ethane C_2H_6	C_2H_5___	Ethyl
Propane C_3H_8	C_3H_7____	Propyl

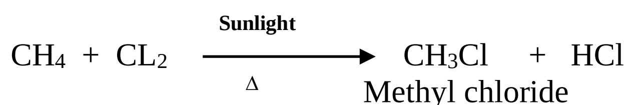
Q#12 Write down the molecular, structural and electronic formula of Mcthane, Ethane, Propane, Butane, Pentane, Hexane, Heptane.

Name	Formula $C_n H_{2n+2}$	Structural Formula	Electronic Formula
Methane	CH_4	H | H — C — H | H	H •• H : C : H •• H
Ethane	C_2H_6	H H | | H — C — C — H | | H H	H H •• •• H : C : C : H •• •• H H
Propane	C_3H_8	H H H | | | H — C — C — C — H | | | H H H	H H H •• •• •• H : C : C : C : H •• •• •• H H H
Butane	C_4H_{10}	H H H H | | | | H — C — C — C — C — H | | | | H H H H	H H H H •• •• •• •• H : C : C : C : C : H •• •• •• •• H H H H
Pentane	C_5H_{12}	H H H H H | | | | | H — C — C — C — C — C — H | | | | | H H H H H	H H H H H •• •• •• •• •• H : C : C : C : C : C : H •• •• •• •• •• H H H H H
Hexane	C_6H_{12}	H H H H H H | | | | | | H — C — C — C — C — C — C — H | | | | | | H H H H H H	H H H H H H •• •• •• •• •• •• H : C : C : C : C : C : C : H •• •• •• •• •• •• H H H H H H

1. **Combustion (burning):** All the alkanes are combustible. They burn in air or oxygen producing CO_2 and H_2O and also liberate heat in this process i.e.

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$, $\Delta H = 890kj/mole$

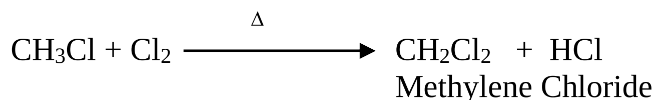
2. **Reactivity:** Alkanes are comparatively un-reactive with other chemicals because they are saturated compounds having only single covalent bonds.
3. **Substitution:** Alkanes give substitution reactions due to their structural stability. They involve the replacement of one or more H-atoms by the atoms of other elements like halogens (F,CI, Br,)



$CH_4 + CL_2 \xrightarrow[\Delta]{Sunlight} CH_3Cl + HCl$

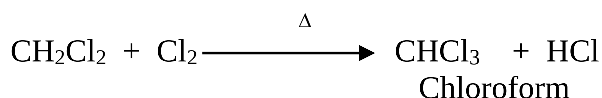
Methyl chloride

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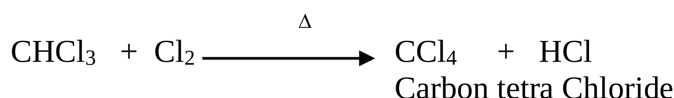
$CH_3Cl + Cl_2 \xrightarrow{\Delta} CH_2Cl_2 + HCl$

Methylene Chloride



$CH_2Cl_2 + Cl_2 \xrightarrow{\Delta} CHCl_3 + HCl$

Chloroform



$CHCl_3 + Cl_2 \xrightarrow{\Delta} CCl_4 + HCl$

Carbon tetra Chloride

Q13. What is homologous series? Write the characteristics of the member of a homologous series?

Ans. A homologous series is series of compounds in which adjacent members differ by a CH_2 unit. The individual members are called homologous. For example the homologous series of alkanes can be represented as C_nH_{2n+2} while for alkenes and alkynes are C_nH_{2n} and C_nH_{2n-2}.

General Characteristics of a homologous series:

1. All compounds in the series contain the same elements and the functional group.
2. All compounds in the series can be represented by a general formula.
3. All two consecutive members differ in their formula by a common difference of - CH_2.
4. All compounds in the series can be prepared by similar methods.
5. All compounds in the series have similar chemical properties.
6. There is a gradual variation in physical properties with increasing molecular weight.
7. The difference in the molecular mass of any two adjacent homologous is 14 a.m.u.

Q#14. a. What do you understand by Isomerism? Illustrate with examples.
b. Write the possible isomerism of butane and pentane.

Ans. There are many organic compounds that have same molecular formulae but differ in their physical and chemical properties due to the different structural arrangement of atoms in them are called isomers or isomerides. (Greek iso-equal, moros - parts) while the phenomenon or the process is known as isomerism.

There two main types of isomerism -:

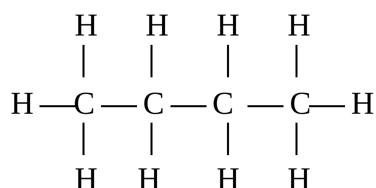
1. Structural or Constitutional isomerism.
2. Stereo-isomerism or Space Isomerism

Characteristics of Isomerism:

1. They have the same molecule formula.
2. They have different structural formula.
3. They have different physical and chemical properties.

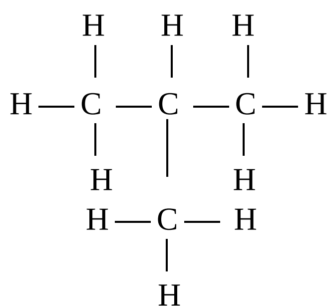
Possible Isomerism of Butane (C_4H_{10}). Butane can have two structural formula as

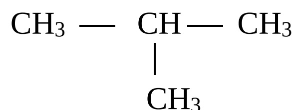
(i)



n- butane

(ii)



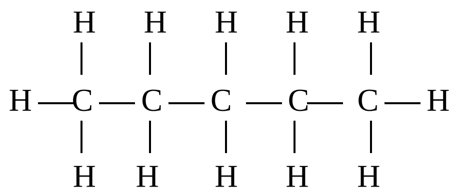


Iso butane (2 methyl propane)

<u>Possible Isomers in pentane (C_5H_{12})</u>

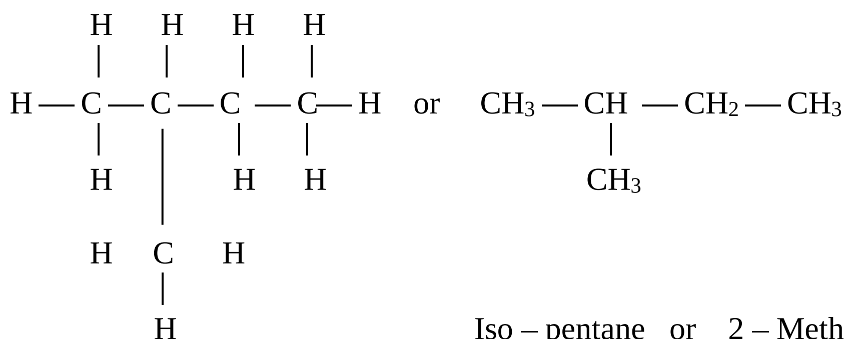
There are three isomers of pentane named n-pentane, Iso-pentane and neo-pentane.

(i)

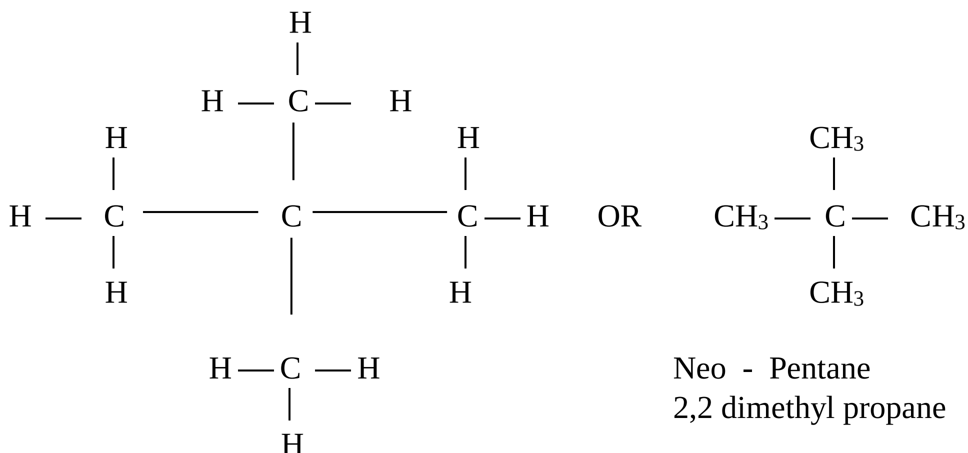


Or $CH_3 — CH_2 — CH_2 — CH_2 — CH_3$ pentane (n-pentane)

(ii)



Iso – pentane or 2 – Methyl butane



Neo - Pentane
2,2 dimethyl propane

With an increase in the no. of C-atoms in a molecule, the number of possible structural isomers increases. Thus there are two butanes, three pentanes, five haxanes and 75 docanes and so on.

Q#15 What are addition reactions? Give an example.

Ans. The reaction in which an unsaturated compound reacts with another substance to give a single product is called an addition reaction. Addition reactions are given by all unsaturated hydrocarbons like alkenes and alkynes which contain double bond or triple bond. In fact, addition reaction is the characteristic property of unsaturated hydrocarbons e.g.

Ethene reacts with one molecule of chlorine to form a saturated compound dichlororo ethane.

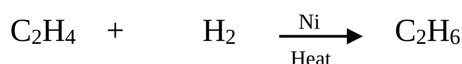


$C_2H_4 + Cl_2 \longrightarrow CH_2Cl - CH_2Cl.$

In this addition reaction, one Cl atom adds to each C—atom and the double bond is reduced to single bond.

Q#16 How do Alkenes reacts with hydrogen?

Ans. The Alkenes react with hydrocarbon when heated presence of catalyst like nickel to form saturated hydrocarbons called Alkanes. For example, ethane reacts with hydrogen when heated in the presence of nickel catalyst to form ethane.



$C_2H_4 + H_2 \xrightarrow[\text{Heat}]{\text{Ni}} C_2H_6$

This is called hydrogenation. It is used to prepare vegetable ghee (Vanaspati) from vegetable oils.

Q#17 What is meant by functional group? Explain with ann example.

Ans. A functional group is an atom or group of atoms in a molecule that gives the molecule its characteristic chemical properties.

The alcohol group — OH group present in ethanol C_2H_5OH is an example of a functional group the functional group is the action group while the hydrocarbon portion remains inert. Some of the important functional groups present in organic compounds are Halo group, Alcohol group, Aldehyde group, Ketone group, Carboxylic group, Alkene group, Alkyne group, ether group, ester , amino and amide group.

Q#18 Write down the IUPAC system of Nomenclature.

Ans. In early days of organic chemistry, each new compound was given an individual name. Such a name was based on the source, some property or some other common reason.

With the rapid growth of organic chemistry, the number of compounds increased fantastically (about 3 million). It became impossible to give common names to such a large number of compounds.

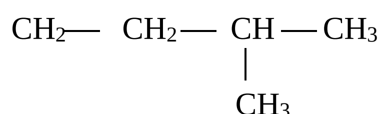
In 1957, the international union of pure and applied chemistry evolved a scheme for giving systematic names to organic compounds on the basis of their structure. This is known as IUPAC system (pronounced as eye-you-pack)

One organic compound can have only one IUPAC name. Knowing the IUPAC name of a compound, we can at once write its structural formula.

Q#19 Write the IUPAC rules for naming Alkanes.

Ans. **Rule1**:- Select the longest continuous carbon chain.

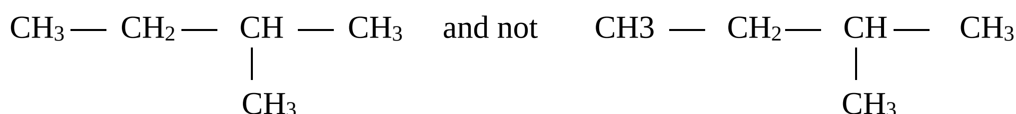
Rule2:- Name the longest chain.



$CH_2 - CH_2 - CH(CH_3) - CH_3$

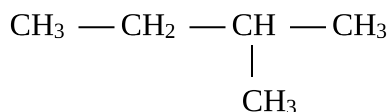
The longest chain is butane

Rule3:- Number the longest chain:- The numbering is started from that end which will give lowest value to substituent.



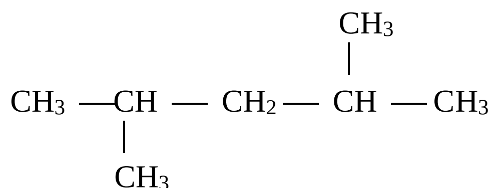
Rule4:- Identify the substituent:-
Name the substituent and indicate its position by the number of the C-atom to which it is attached.

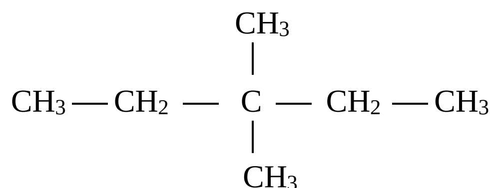
Rule5:- Perfix the position number and name of the substituent onto the parent name.



2- methyl butane

Rule6:- Identify the substituent by names and position number. Use prefix di, tri, tetra etc.

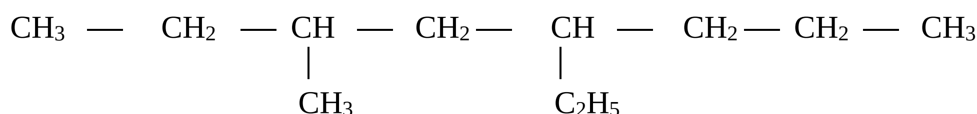




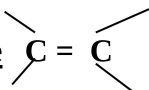
2,4- dimethyl pentane

3, 3 – dimethyl pentane.

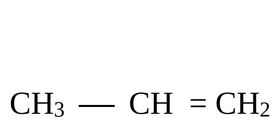
Rule 7:-When two or more different substituents are present. These names are arranged in alphabetic
order

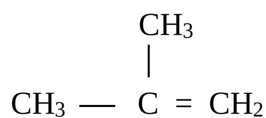


5- ethyle-3-methyloctane

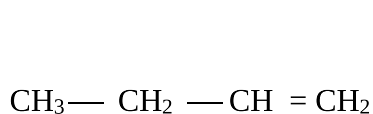
IUPAC RULES For Alkene 

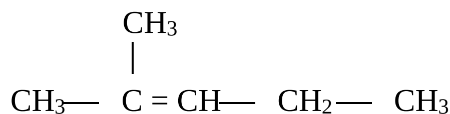
The alkene group is a carbon – carbon double bond. The compounds containing alkene group are known as alkenes. For example.



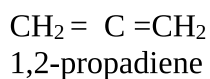


Propene 2-methyl propene





1-Butene 2-methyl -2- pentene

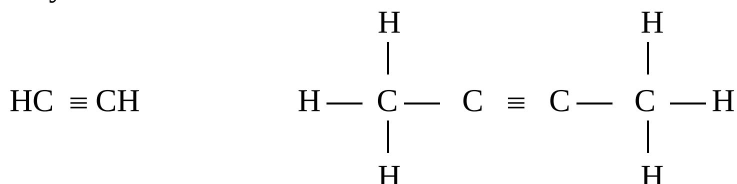


1,2-propadiene

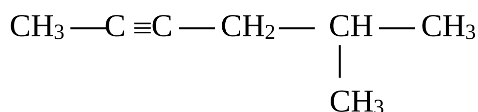
IUPAC Rules for Alkynes:-

The alkynegroup is a carbon-carbon triple bond. The compounds containing alkyne group are known as alkynes.

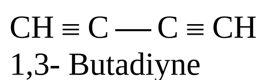
$HC \equiv CH$



Ethyne 2- Butyne



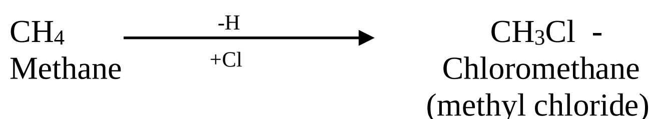
5- methyl – 2-hexyne



1,3- Butadiyne

Nomenclature of Haloalkanes or Alkyle halides

Haloalkanes are compounds which contain carbon- halogen bonds. When one hydrogen atom of an alkane is replaced by a halogen atom, we get haloalkanes. i.e.



CH_3Cl - Chloromethane (methyl chloride)

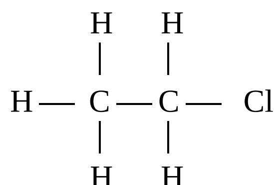
The general formula of haloalkanes is $C_nH_{2n+1} – X$ where X represents Cl, Br or I. In the IUPAC method, haloalkanes are named after the parent alkane by using a prefix to show the presence of the halo group such as chloro (-Cl), Bromo(-Br) and Iodo (-I) group.

The IUPAC name of (CH_3Cl) is chloromethane CH_3Cl or CH_3— Cl or

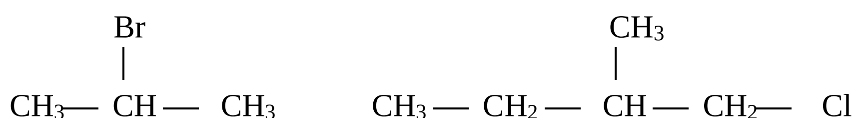
```
      H
      |
H  —  C —  Cl
      |
      H
```

The common name of CH_3Cl is methyl chloride. The IUPAC name of (C_2H_5Cl) is chloroethane

C_2H_5Cl or CH_3— CH_2 — Cl or

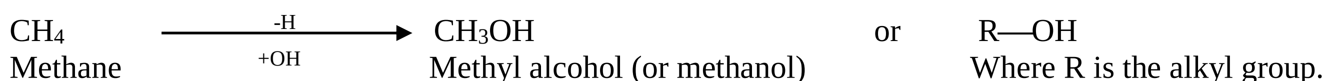


The common name of C_2H_5Cl is ethyle chloride.



2- Bromo propane 1- chloro – 2-methyl butane

Nomenclature of Alcohols:- Alcohols are compounds in which a hydroxyl group (-OH) is bonded to a saturated carbon. When one hydrogen atom of an alkane is replaced by a hydroxyl group, we get alcohol.



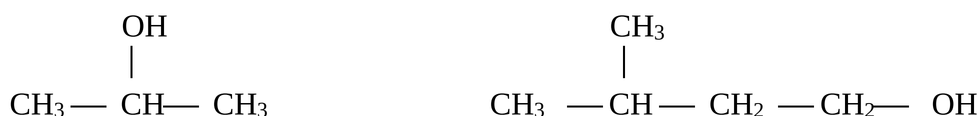
Methane Methyl alcohol (or methanol) Where R is the alkyl group.

The general formula of alcohols is $C_nH_{2n+1} – OH$

In the IUPAC method, the last ‘e’ of the parent alkane is replaced by ‘ol’ to indicate the presence of OH group.

i.e. Alkane-e +ol ⟶ Alkanol

The IUPAC name of CH_3OH is methanol while as the common name is methyl alcohol. Similarly the IUPAC name of C_3H_7OH is propanol and the common name is propyl alcohol.



2-propanol 3- methyl – 1- butanol

Nomenclature of aldehyde:- Aldehydes are carbon compounds in which an aldehyde group (-CHO) group is attached to a carbon atom. The general formula of aldehyde is $CnH_{2n}O$, when n=1,2,3…….
In the IUPAC method, the last 'e' of the parent alkane is replaced by 'al' to indicate the presence of aldehyde group.

i.e. Alkane – e + al = Alkanal.

```
                                                                                    O
                                                                                    ||
The IUPAC name of HCHO is methanal HCHO or H — CHO   or H —  C — H
```

The common name of methanal is formaldehyde. The IUPAC name of CH_3CHO is ethanal whereas its common name is acetaldehyde. Similarly, the IUPACname of C_2H_5CHO is propanal and its common name is propionaldehyde.

```
                                                                H     H    O
                                                                |     |    ||
CH3—CH2—CHO    or    CH3 — CH2 —CHO    or    H — C — C — C — H
                                                                |     |
                                                                H     H
```

Nomenclature of ketones:-

Ketones are compounds in which the carboxyl group (C=O) is bonded to two organic groups. A ketone must contain at least 3-carbon atoms in its molecule. The simplest ketone is CH_3COCH_3 (propanone) the general formula of ketone is $CnH_{2n}O$.
Where n= 3, 4, 5………
In the IUPAC method, the last 'e' of the parent alkane is replaced by 'one' to indicate the presence of a ketone group.

The IUPAC name of CH_3COCH_3 is propanone and its common name is Acetone (dimethyl ketone)

```
                          O                  H    O    H
                          ||                 |    ||   |
CH3COCH3  or CH3—  C — CH3   or H  — C — C— C —  H
                                             |         |
                                             H         H
```

The IUPAC name of CH_3 CO C_2H_5 is butanone and its common name is Ethyl methyl ketone. Similarly, for $CH_3COC_3H_7$, the IUPAC name is pentanone and the common name is methyl propyle ketone.

Nomenclature of carboxylic acids:-

Carboxylic acids are compounds which contain the carboxylic acids are compounds which contain the carboxyl group(-COOH). They are also called organic acids.

They occur in fatty acids, butter, ghee etc. the general formula of organic acid is Cn H_{2n+1} COOH or RCOOH. Where R is an alkyl group. The name carboxyl is derived from carboxyl (C=O) and hydroxyl (-OH)

In the IUPAC system, the carboxylic acids are named as alkanoic acids. The IUPAC name of an organic acid is obtained by replacing the last electron of the parent alkane by 'oic' and adding the word 'acid' to the name.

The IUPAC name of HCOOH is methanoic acid and its common name is formic acid.

The first five organic acids are given below:

	Formula	Common name	IUPAC
n=0	HCOOH	Formic acid	Methanoic acid
n=1	CH_3COOH	Acetic acid	Ethanoic acid
n=2	C_2H_5COOH	Propanoic acid	Propanoic acid
n=3	C_3H_7COOH	Butyric acid	Butanoic acid
n=4	C_4H_9COOH	Valeric or Camroic acid	Pentanoic acid.

Chemical properties of carbon compounds

Combustion:- The process of burning of a carbon compound in air to give carbon dioxide, water heat and light is known as combustion.

All the alkanes are combustile. When they are ignited in the presence of excess oxygen, they burn to form CO_2 and H_2O with the liberation of large amount of heat energy.



$CH_4 + 2O_2 \xrightarrow{\text{Heat}} CO_2 + 2H_2O + \text{Heat} + \text{light}$

When alkanes are burnt in insufficient supply of oxygen, they form carbon monoxide and carbon. For example:



$2CH_4 + 3O_2 \longrightarrow 2CO + 4H_2O$



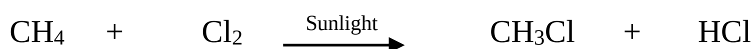
$CH_4 + O_2 \longrightarrow C + 2H_2O$

The unsaturated hydrocarbons (Alkanes and alkynes) do not undergo complete combustion and hence burn with luminous, yellow sooty flame and produce carbon monoxide and water because they contain higher parentage of carbon which does not get oxidized completely in the insufficient oxygen present in air.

However, if unsaturated hydrocarbons are burned in pure oxygen, then they will burn completely and produce extremely high temperature. For example, when acetylene burn in pure oxygen, it produces extremely high temperature (3000^0C) which is used for welding and cutting of metals.

Substitution reaction:- Alkanes are comparatively uncreative due to their structural stability. They however, undergo substitution reaction. In the substitution reaction, one or more hydrogen atoms of a hydrocarbon are replaced by the atoms of other elements like halogens (F , Cl , Br, I)

For example methane reacts with chlorine to give methyl chloride and HCl in presence of ultraviolet light or diffused sunlight or at a temperature of 300 – 400^0C.



$CH_4 + Cl_2 \xrightarrow{\text{Sunlight}} CH_3Cl + HCl$

Methyl chloride

(Chloro methane)



$CH_3Cl + Cl_2 \xrightarrow{\Delta} CH_2Cl_2 + HCl$

Methylene chloride

(Di chloro methane)

CH_2Cl_2 $+Cl_2$  Δ $CHCl_3$ + HCl

Chloroform

(Trichloro methane)

$CHCl_3$ + Cl_2  Δ CCl_4 + HCl

Carbon tetrachloride

(Tetra chloro methane)

Addition reaction:- The reaction in which an unsaturated compound reacts with another substance to give a single product is called an addition reaction. Addition reactions are given by all unsaturated hydrocarbons like alkenes and alkynes which contain double bond or triple bond. In fact, addition reaction is the characteristic property of unsaturated hydrocarbons-. For example,

Ethene reacts with one molecule of chlorine to form a saturated compound dichloroethane

C_2H_4 + Cl_2  CH_3 Cl — CH_3 Cl

1,2 dichloro ethane

In this addition reaction, one Cl atom adds to each C-atom and the double bond is reduced to single bond.

<u>Addition reaction of ethene with hydrogen</u>:- Ethene reacts with hydrogen, when heated under pressure and in the presence of Ni , Pt , or Pd as catalyst to produce saturated hydrocarbons. A hydrogenation reaction carried in this process is called catalytic hydrogenation.

$CH_2 = CH_2$ + H_2  Ni CH_3 — CH_3

Ethene Δ Ethane

The process of hydrogenation is used to prepare vegetable ghee (vanaspati) from vegetable oils.

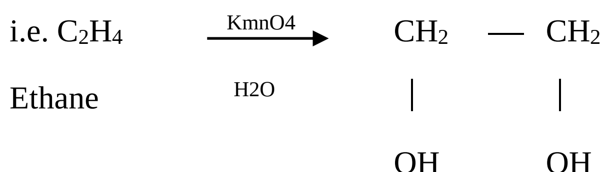
<u>Hydrogenation of oils:-</u> Hydrogenation reaction is used in the manufacture of vanaspati ghee from vegetable oils. The vegetable oils such as groundnut oil, cotton seed oil and mustard oil contain double bonds in their molecules. When reacted with hydrogen in the presence of nickel as catalyst, they are converted into vanaspati ghee which is solid at room temperature like butter or ghee.

Vegetable oil + H_2  Ni Vegetable ghee

(Unsaturated hydrocarbon) Vanspati ghee or

(Saturated hydrocarbon)

Oxidation reaction:- When alkenes react with cold dilute alkaline solution of potassium permanganate ($KMNO_4$), ethyle glycol is formed.



i.e. C_2H_4 $\xrightarrow[H2O]{KmnO4}$ $CH_2 — CH_2$ (with OH on each CH_2)

Ethane

OH OH

Ethylene glycol.

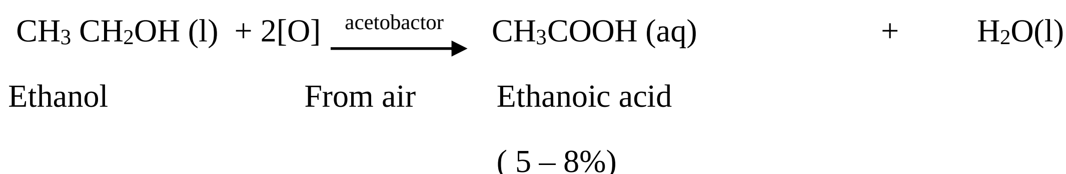
Since the bright purple colour of $Kmno_4$ disappears during the reaction. It is used as a test for the presence of a double bond.

Q#20 Give the preparation, properties and uses of ethanoic acid (Acetic acid).

Ans. Ethanoic acid (acetic acid) is well known in the form of vinegar. Vinegar contains about 5-8 % of ethanoic acid. It is present in biological fluids and plant extracts.

Preparation:- Ethanoic acid can be prepared by several methods.

i) By enzymatic oxidation of ethanol:- It can be obtained by the oxidation of ethanol by air in the presence of acetobactor enzyme.

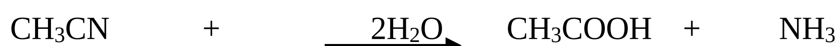


$CH_3\,CH_2OH\,(l) + 2[O] \xrightarrow{acetobactor} CH_3COOH\,(aq) + H_2O(l)$

Ethanol From air Ethanoic acid

(5 – 8%)

ii) It can be prepared by the hydrolysis of alkyl cyanide



$CH_3CN + 2H_2O \longrightarrow CH_3COOH + NH_3$

iii) Methanol when reated with carbon monoxide in the presence of iodine-rhodium catalyst gives ethanoic acid.



$CH_3OH(l) + CO(g) \xrightarrow{I2 – Rh} CH_3COOH$

Methanol Carbon monoxide Ethanoic acid

Physical properties:- Some common physical properties of ethanoic acid are described below:-

1). At ordinary temp, ethanoic acid is a colourless liquid with a strong pungent smell and sour taste.

2). On cooling below 16.5^0C it forms ice-like crystals that is why, it is named as glacial acetic acid.

3). It has a corrosive action on the skin and causes blisters.

4). It is miscible with water due to the formation of hydrogen bonds with water molecules.

5). It dissolves sulphur, iodine and many other organic compounds.

Chemical properties:- The main chemical reactions given by ethanoic acid are described below:

1) With water:- In aqeous solutions it ionizes to produce H_3O^+ and CH_3COO^- ions.

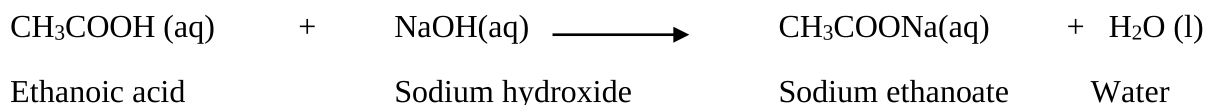


$CH_3COOH(l)$ + H_2O (l) $\rightleftharpoons$ CH_3COO^- (aq) + H_3O^+ (aq)

Ethanoic acid — Ethanoate ion — Hydronium ion

2) **Action on ltmus:-** Ethanoic acid is acidic in nature being acidic in nature, ethanoic acid terms blue litmus solution red.

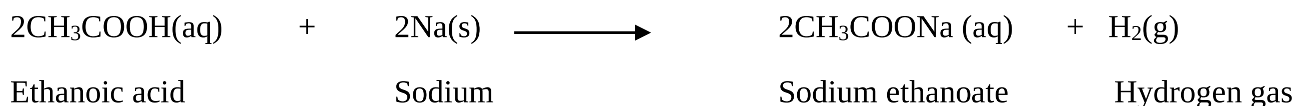
3) **With sodium hydroxide:-** It reacts with strong alkali such as NaOH giving sodium ethanoate and water.



CH_3COOH (aq) + NaOH(aq) $\longrightarrow$ CH_3COONa(aq) + H_2O (l)

Ethanoic acid — Sodium hydroxide — Sodium ethanoate — Water

4) **With metals**:- Ethanoic acid reacts with active metals to form metal ethanoates and H- gas.

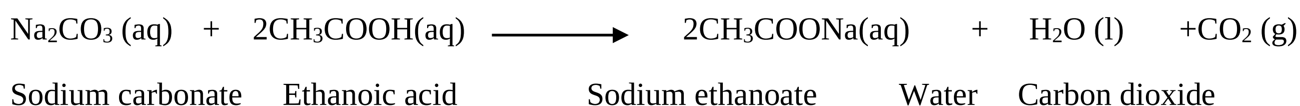


$2CH_3COOH$(aq) + 2Na(s) $\longrightarrow$ $2CH_3COONa$ (aq) + H_2(g)

Ethanoic acid — Sodium — Sodium ethanoate — Hydrogen gas

5) With sodium carbonate and sodium bicarbonate:-

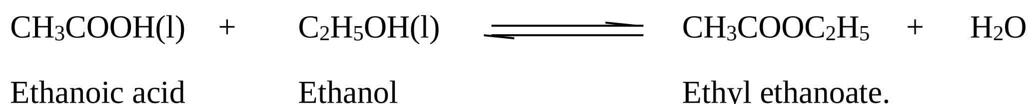
Ethanoic acid decomposes sodium bicarbonate and sodium carbonate with a rapid evolution of CO_2 gas.



Na_2CO_3 (aq) + $2CH_3COOH$(aq) $\longrightarrow$ $2CH_3COONa$(aq) + H_2O (l) + CO_2 (g)

Sodium carbonate — Ethanoic acid — Sodium ethanoate — Water — Carbon dioxide

6) **Reaction with alcohols**:- Ethanoic acid reacts with alcohols in the presence of dehydrating agents e.g. concentrated H_2SO_4 to form ester.



$CH_3COOH(l)$ + $C_2H_5OH(l)$ $\rightleftharpoons$ $CH_3COOC_2H_5$ + H_2O

Ethanoic acid — Ethanol — Ethyl ethanoate.

The reaction of carboxylic acid with an alcohol to form an ester is called esterification.

Tests for carboxylic acids:-

1) **Sodium bicarbonate test**:- The organic compound to be tested is put in a test tube and a little amount of sodium bicarbonate is added to it. Evolution of CO_2 gas shows that the given compound is carboxylic acid.
2) **Ester test for acids**:- The organic compound is warmed with some ethanol and few drops of concentrated sulphuric acid. A sweet smelling ester shows that the organic compound is a carboxylic acid.

Uses of ethanoic acid:-

1) Ethanoic acid is used in the manufacture of various dyes, perfumes and a rayons.
2) Salts of ethanoic acid are used in paints and also in certain medicines.
3) It is used for making synthetic vinegar which is used in pickles etc.

4) It is used as a solvent.

5) It is used for coagulating the latex.

6) It is used for making white lead.

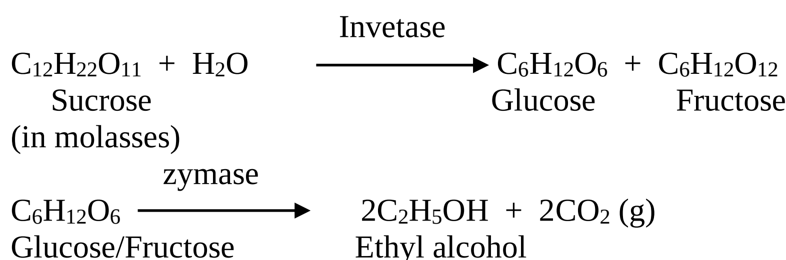
7) It is used for making cellulose acetate.

8) It is used for making acetone.

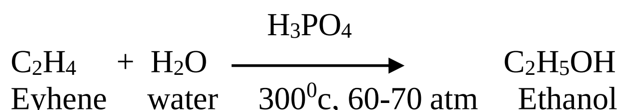
Q.21 Give the preparation, properties and uses of ethyl alcohol (ethanol).

Ans. Ethyl alcohol (C_2H_5OH) is the second number of the homologous series of alcohols. Ethyl alcohol is the alcohol of wine, bear, whisky and similar beverages. Ethyl alcohol is also known as grain alcohol, since it can be prepared from starchy grains.

Preparation:- It is prepared on a large scale by the fermentation of sugars present in molasses (cheap source of glucose, fructose and sucrose) in the presence of yeast. The enzymes **invertase** and **zymase** present in the yeast act as catalyst in converting sugar into ethanol and $C0_2$.



1. It is obtained by reacting ethene with water in the presence of phosphoric acid (H_3PO_4) at a temperature of 300^0C and 60 -70atm.

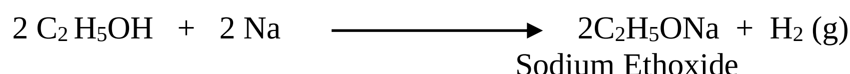


Physical properties:-

1. It is a colourless, volatile liquid with a characteristic pleasant odour and burning taste.
2. It boils at 78°C and freezes at -118^{0}C.
3. Its specific gravity is 0.789
4. It is soluble in water as well as in all organic and inorganic solvents.
5. It is a neutral compound and has no effect on the colour of litmus.
6. It is lighter than water.
7. It is poisonous in nature.
8. It is a covalent compound and hence does not conduct electricity.

Chemical Properties of Ethanol:

1. Reaction with Na or K :- Ethyl alcohol reacts with sodium to form the corresponding ethoxides and H - gas.



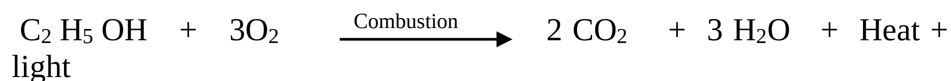
2. **Reaction with Phosphorus halide:-** It reacts with phosphorus halide to give ethyl halide.



$C_2H_5OH + PCl_5 \longrightarrow C_2H_5Cl + POCl_3 + HCl$

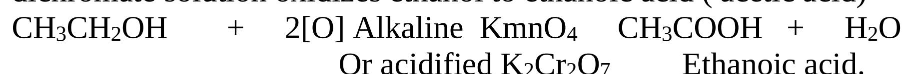
Ethyl chloride phosphorous oxychloride

3. **Combustion:-**It burns in air with a blue flame to form CO_2 and water vapour.



$C_2H_5OH + 3O_2 \xrightarrow{\text{Combustion}} 2CO_2 + 3H_2O$ + Heat + light

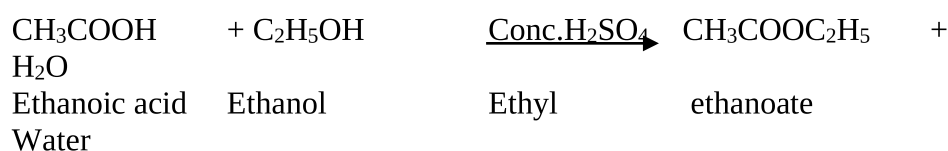
4. **Oxidation:-** Alkaline potassium permanganate or acidified dichromate solution oxidizes ethanol to ethanoic acid (acetic acid)



CH_3CH_2OH + 2[O] Alkaline $KMnO_4$ Or acidified $K_2Cr_2O_7$ CH_3COOH + H_2O

Ethanoic acid.

5.**reaction with ethanoic acid (Esterification reaction):-** Ethanol when heated with ethanoic acid in the presence of concentrated H_2SO_4 to form a sweet smelling ester (ethyl ethanoate).

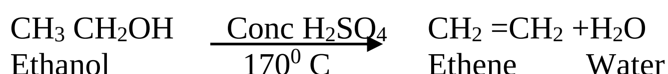


$CH_3COOH + C_2H_5OH \xrightarrow{\text{Conc.}H_2SO_4} CH_3COOC_2H_5 + H_2O$

Ethanoic acid Ethanol Ethyl ethanoate Water

In this reaction, conc. H_2SO_4 acts as a catalyst as well as a dehydrating agent.

6.Dehydration:- When ethanol is heated with excess of conc. Sulphuric acid at 170^0 C, it gets dehydrated to form ethane.



$CH_3CH_2OH \xrightarrow[170^0 C]{\text{Conc }H_2SO_4} CH_2{=}CH_2 + H_2O$

Ethanol Ethene Water

Tests for an alcohol

1. Sodium metal test:- Add a small piece of sodium metal to the organic liquid , taken in a dry test tube. If bubbles of hydrogen gas are produced , it indicates that the given organic liquid is an alcohol.
2. Ester tests for alcohol:- The organic compound is warmed with some ethanoic acid and a few drops of conc. Sulphuric acid. A sweet smell indicates that the given organic compound is an alcohol.

Uses:

1. It is used in the manufacture of alcoholic drinks, like whisky, wine, bear etc.
2. It is used in the manufacture of drugs and perfumes.
3. It is used in thermometers and spirit lamps.
4. It is used as a preservative for biological specimens.
5. It is used in the manufacture of acetaldehyde, acetic acid, ethyl chloride and ethyl acetate.
6. It is used as an industrial solvent.
7. It is used in hospitals as an antiseptic to sterilize wounds and syringes.
8. It is used in varnishes.

9. It is used in the manufacture of synthetic rubber.
10. It is used as a substitute of petrol in scooters and cars.
11. It is used as antifreeze for automobile radiators.

Q.22 What are soaps? How will you manufacture the soap?

Ans. Soaps are the substances that are used for cleaning and washing actions. They are sodium or potassium salts of fatty acids like oleic acid. stearic acid, palmitic acid, lauric acid and myristic acid. Ordinary soaps are the products of hydrolysis of oils and fats with sodium hydroxide.

1. Sodium Stearate ($C_{17}H_{35}COONa$): It is the sodium salt of fatty acids (saturated acids called stearic acid $C_{17}H_{35}COOH$). A higher portion of saturated salts gives hard soaps.
2. Sodium Palnitate ($C_{15}H_{31}COONa$): It is the sodium salt of long chain saturated fatty acids called Palmitic acid $C_{15}H_{34}COOH$.
3. Sodium Oleate ($C_{17}H_{33}COONa$): It is a sodium salt of a long chain unsaturated fatty acids called Oleic acid $C_{17}H_{33}COOH$. Higher proportion of this salt yields soft soaps.

Preparation of Soaps:- Soap is prepared by heating fats or oils with sodium or potassium hydroxide solution (Lye). The process of making soaps by the alkaline hydrolysis of oils and fats is called sapnofication.



$$\text{Oil or fat} + \text{Alkali} \xrightarrow{\text{Heat}} \text{Soap} + \text{Glycerol}$$



$$C_3H_5(COOC_{17}H_{35})_3 + 3NaOH \longrightarrow 3C_{17}H_{35}COONa \text{ (Soap)} + C_3H_5(OH)_3 \text{ (Glycerine)}$$

During heating and boiling the mixture should be constantly stirred. A punch of NaCl and few flower petals should be added, the mixture is heated until thick paste is obtained. The soap separates out from the solution and thus the crust of soap is removed and allows to set and harden. The harden mass is then cut into desired shapes and sizes and are thus packed for marketing.
Preparation of soap at home or in the laboratory: Add 10ml of a 40% NaOH solution to 10ml of cotton seed oil in a beaker. Boil the mixture with continuous stirring till a thick paste is obtained. Add some hardening agent i.e. Na_2CO_3 to harden the soap.



$$\text{Oil (fat)} + \text{Base} \xrightarrow{\text{Heat}} \text{Soap} + \text{Glycerol}$$

When the reaction is complete, both the products are in the form of aqueous solution. To precipitate out the soap, add some NaCl, the soap thus obtained is dried and cut into bars and cakes.
Cleansing action of soap or how soap works: Cleansing soap function by acting amulsifying agents which means that oil and grease to be removed from the surface of skin or fabric are broken into smaller droplets. Each one of the small droplets is surrounded by a film of soap which is washed away with water.

The soap consists of two parts i.e., the long hydro carbon part ($C_{17}H_{35}$) of the soap that is oil soluble (liphopholic) and the other charged end (COONa) is water soluble (hydrophilic). As soap water is poured over the skin or a dirty garment, the hydro-carbon tails of the soap molecules per into the oil, while the negative head is held in water. The grease layer is then separated from skin by rubbing or from garment by tumbling and stirring.

Advantages of Soap:
1. Soap is an excellent cleansing agent having 100% bio degradability.
2. Micro –organisms present in sewage water easily oxidize soap to CO_2 and water and hence there can be no pollution problem.

Disadvantages of soap:

1. It can be used in soft water but not in hard water, because a large amount of soap is wasted in reacting with calcium and magnesium ions in hard water to form a scum.
2. It cannot be applied in acetic medium as it sticks to the fabrics and hence causes problem during dyeing and drying.

Q.23 What are synthetic detergents and write advantages of synthetic detergents over soaps?

Ans. Soaps are good cleansing agents yet they become ineffective if the water is hard. Scientists have developed synthetic cleansing agents and which are not prepared from vegetable oil. These cleansing agents are called detergents.

Synthetic detergent ions of the sodium salt of a long chain benzene sulphonic acid or the sodium salt of a long chain alkyl hydrogen Sulphate.

Sodium Lauryl sulphate ($C_{12}H_{25}OSO_3Na$) is an example of synthetic detergent. It does not form Scum with the ions Ca^{2+} or Mg^{2+} and hence washes well even in hard water.

Advantages of detergents over Soaps:

1. Synthetic detergents are used even with hard water whereas soaps are not suitable for use with hard water.
2. Synthetic detergent is prepared from hydrocarbons of petroleum so they help us save vegetable oils for human consumption.
3. Detergents can be used in acidic solutions whereas soaps cannot be used in the acidic medium
4. Detergents have more cleaning action than soaps.
5. Detergents are more soluble in water than soaps.
6. Detergents may be used for cotton as well as woolen clothes.

Q24. Give the differences between soap and synthetic detergents.

Soaps	**Detergents**
1. Soaps are the salts of the long chain fatty acids and the ionic group is $COO^- Na^+$.	**1.** They are the sodium salts of long chain benzene sulphonic acids and ionic group in a detergent is SO_3Na^+
2. Soaps are not suitable for washing with hard water.	**2.** They can be used both in hard and soft water.
3. They are prepared from animal fats or vegetable oils.	**3.** They are prepared from the hydrocarbons of petroleum.
4. Soaps are biodegradable.	**4.** They are non-biodegradable.

Classification of Elements Chemistry

Introduction: By the middle of the last century, more than 50 chemical elements were known and it was realised that a study of the chemistry of those elements would be easier if the elements could be classified on the basis of their properties. Following are the reasons for the classification of elements.

a) Classification may help to study elements better.
b) Classification may lead to correlate the properties of elements with some fundamental properties.
c) Classification may further reveal relationship between one element and another element.

A) The early attempt to classify elements involved dividing them into metals and non-metals. Later, metals were further classified as alkali metals and alkaline earth metals. The division of elements was done by Lavoisier. This was based on certain physical and chemical properties.

Reasons for rejecting classification on the basis of metals and non-metals.

1. This type o f classification hardly serves any purpose.
2. There is no justification for more active metals or more active non metals.
3. Certain elements had metallic as well as non- metallic character and were named metalloids.

B) Classification on the basis of Dobereiner's triads:

In the year 1829, a German che mist Johann W. Doberiner classified elements having similar chemical and physical properties into groups of three. These groups were called triads. It states that atomic mass of the middle element of a triad is completely arithmetic mean of the atomic masses of the other two elements.

TABLE – 1 : EXAMPLES OF DOBEREINER'S LAW OF TRIADS

1.	**Triad**	**Calcium**	**Strontium**	**Barium**
	Atomic mass	40	88	137
	Mean atomic mass		$\frac{40+137}{2}=\frac{177}{2}=88\cdot5$	
2.	**Triad**	**Lithium**	**Sodium**	**Potassium**
	Atomic mass	7	23	39
	Mean atomic mass		$\frac{7+39}{2}=\frac{46}{2}=23$	
3.	**Triad**	**Chlorine**	**Bromine**	**Iodine**
	Atomic mass	35·5	80	127
	Mean atomic mass		$\frac{35\cdot5+127}{2}=\frac{162\cdot5}{2}=81\cdot25$	

The basic achievement of classification on the basis of triads is that it recognized for the first time the relationship between atomic masses and properties of an element.

Reason for rejecting classification on the basis of triads:

2) The classification into triads left room for the chance. It is possible to group quite dissimilar elements in triads.
3) Quite a large no. of elements could not be grouped into triads.

C) Classification on the basis of Newland's law of octaves:-

In 1864, John Newland who in addition to being a chemist was also a lover of music arranged many of the known elements in the increasing order of their atomic masses. He found that the properties of the eight element were similar to that of first element, much the same away the repetition of the musical notes in an octave. The regularity of repetition was formed by him as law of octaves. The noble gases were not known at that time and therefore did not find a place in the scheme of elements of John Newland's.

In the table, if we start with lithium as the first element, then the eight element is sodium and the further eighth element is potassium (K) . The above elements have similar chemical and physical properties. Similarly, Beryllium (Be), Magnesium (Mg) and calcium (Ca) have similar physical and chemical properties.

Law of octaves:- When the elements are arranged in the order of increasing atomic mass, the properties of eighth element are the repetition of the properties of the first element.

Achievement of law of Octaves:-

1) Atomic weight of an element was recognized as the basis of classification.
2) The periodicity as a property of element was recognized for the first time.

Reasons for rejecting law of Octaves:

1) It did not extend beyond calcium (Ca) and could not include all elements.
2) He assumed that only 56 elements existed in nature and no more elements would be discovered in future.
3) It did not recognize transitional elements.
4) Position of hydrogen was not justified along with fluorine and chlorine on the basis of the chemical properties.
5) Iron element (Fe) which resembles cobalt (CO) and nickel (Ni) elements in properties was placed for away from these elements.

1 **H**	**2** **Li**	**3** **Be**	**4** **B**	**5** **C**	**6** **N**	**7** **O**
8 **F**	**9** **Na**	**10** **Mg**	**11** **Al**	**12** **Si**	**13** **P**	**14** **S**
15 **Cl**	**16** **K**	**17** **Ca**				

Q State Mendeeleef's periodic law. Give advantages and anoneolies of his classification.

Ans. In 1869, Dmitri Mendeeleef, a Russian chemist tried ro arrange all the elements known at that time in the form of a table on the following basis:

a) Increasing order to atomic mass of elements.
b) Similarity in the chemical properties of elements.

In his arrangement, he found that elements with similar physical and chemical properties re-occur after regular intervals. Thus he gave a periodic law which states that, " The physical and chemical properties of all elements are periodic functions of their atomic masses".

Description of Mendeeleef's periodic table of elements:

1) There are eight vertical columns called groups. Groups from 1- 7 are subdivided into two subgroups. a and b Groups consists of three sets each and containing 3 –elements.
2) The properties of elements in same subgroup (or main group) are similar.
3) The horizontal rows in periodic table are called periods.
4) In a period, the properties of elements gradually change from metallic to non-metallic character.
5) There are few gaps in the p-table.
6) Some of the spaces left for the unknown elements are listed below.

Eka- Aluminium Which is Gallium.
Eka- Silicon Which is Germanium
Eka- Boron Which is Scandium

	GROUP I	GROUP II	GROUP III	GROUP IV	GROUP V	GROUP VI	GROUP VII	GROUP VIII
Oxides →	R_2O	RO	R_2O_3	RO_2	R_2O_5	RO_3	R_2O_7	RO_4
Hydrides →	RH	RH_2	RH_3	RH_4	RH_3	RH_2	RH	—
PERIODS ↓ 1	H 1.0							
2	Li 7.0	Be 9.1	B 11.0	C 12.0	N 14.0	O 16.0	F 19.0	
3	Na 23.0	Mg 24.3	Al 27.0	Si 28.4	P 31.0	S 32.0	Cl 35.5	
4 1st series :	K 39.1	Ca 40.1	... 44	Ti 48.1	V 51.4	Cr 52.1	Mn 55.0	Fe 55.8 Co 58.9 Ni 58.7
4 2nd series :	Cu 63.5	Zn 65.4	... 68	... 72	As 75	Se 79	Br 79.9	
5 1st series :	Rb 85.4	Sr 87.6	Y 89.0	Zr 90.6	Nb 94.0	Mo 96.0	Tc 99	Ru 101.0 Rh 102.9 Pd 106.4
5 2nd series :	Ag 107.9	Cd 112.4	In 114.0	Sn 119.0	Sb 120.0	Te 127.6	I 126.9	
6 1st series :	Cs 132.9	Ba 137.3						
6 2nd series :	Au 197.2	Hg 200.0						

Merits of M-periodic table:-

1. Mendeleev classified the elements on the basis of atomic mass as compared to early attempts.
2. Some gaps were left knowingly by him for undiscovered elements. This accelerated the process of discovering these elements.
3. It could predict the properties of large number of elements on the basis of their position in the periodic table.
4. It could predict the errors on the atomic masses of elements based on their position in the table.
5. He left vacant spaces in his table for undiscovered elements like Gallium (Ga), Scandium (Sc) and Germanium (Ge). He predicted their properties on the basis of their position. Later when these elements were discovered, their properties were found to be similar and were placed in the gaps without disturbing the table.
6. Mendeleev’s p-table could accommodate noble gases when they were discovered.

Demerits of Mendeleev’s periodic table:

Some of the main defects in the M-periodic table are given below:

1) The position of hydrogen is not certain, as it resembles both with alkali metals and halogens . This defect is still unsolved.
2) There were three anomalous pairs in which atomic weight of preceding element is higher than that of following elements.

Proceeding element	Following element
Argon (39.9)	Potassium (39.1)
Cobalt (58.9)	Nickel(58.6)
Tellurium (!27.6)	Iodine (126.9)

3) Isotopes could not be provided separate places in the periodic table.

4) Certain chemically similar elements e.g copper and mercury or gold and platinum are placed in different groups. While some other dissimilar elements are grouped together e.g copper, silver and gold though they are dissimilar.
5) Lanthanides (atomic no. 57 – 71) and Actinides (atomic no. 89 – 103) do not find their proper places in the periodic table.
6) Mendeleev's concept of transitional elements was defective.
7) Mendeleev did not explain the cause of periodicity among elements.

Q State modern periodic law. Give the characteristics of modern periodic table.

Ans. In 1913, H.G.J Mosely discovered that the physical and chemical properties of the atoms of the elements are determined by their atomic numbers and not by their atomic mass. According to modern periodic law, "the physical and chemical properties of elements are a periodic function of their atomic numbers".

Modern periodic table:- The systematic arrangement of elements into groups and periods on the basis of the order of increasing atomic number and similarities in chemical properties is called modern periodic table.

The modern periodic table was prepared by Neil Bohr . It is also known as long form of periodic table. In the periodic table he arranged elements in periods and groups on the basis of similarities and differences in their electronic configuration.

It has been observed that if the elements are arranged in order of their increasing atomic number,. The elements having similar properties are repeated after a regular interval.

Characteristics of long form of periodic table:

1. The subgroups A and B are separated in this table.
2. The transition elements (d – block elements) are accommodated in the middle of table between first two groups and last six groups. These are labeled as 3 – 12.
3. The strongly metallic elements occupy 1 and 2 group on the left side of the transitional elements.
4. The non metallic elements are placed on the right side of transitional elements.
5. The rare gases are placed in zero groups, at the end of periodic table.
6. The elements occupying left and right wing of transitional elements are called normal representative elements. They are numbered as 1, 2 and 13 – 18.
7. The rare earths lanthanides and actinides are called inner transitional elements. They are kept outside the periodic table to mark their peculiar properties.
8. The horizontal rows of elements in the periodic table are called periods. There are seven periods. The first period contains only two elements namely hydrogen and helium. It is called very short period. The second period has eight elements (Li – Ne). It is called short period.

   The third period has also eight elements (Na – Ar). It is also called short period. The fourth and fifth periods contain 18 elements K- Kr and Rb – Xe. They are called long period.

   The sixth period has 32 elements. It is called very long period. The seventh period is incomplete and contains 29 elements. It is also called very long period.
9. The vertical columns in the periodic table are called groups. There are 18 groups in the long form of periodic table. Group 1 and 2 constitute alkali and alkaline earth metals whereas group 17 constitutes halogens. The group 18 is known as zero group.

   The elements in group 3 – 12 are called transitional elements. Unlike normal elements, the valence shell and penultimate (shell before valence shell) are incomplete.

Q Give the merits and advantages of long form of periodic table.

Ans. Merits of long form of periodic table:-

1. The classification of elements is based on the basic property of elements i.e. atomic number.
2. It relates position of an element to its electronic configuration. Each group of elements have similar electronic configuration in valence shell and hence have similar properties.
3. It explains variations and similarities in the properties of elements in terms of electronic configuration.
4. It explains the reason for the periodicity in properties of elements.
5. It easily explains as to why the properties of the elements are repeated at regular intervals of 2, 8, 18 and 32.
6. The position of isotopes in the periodic table has been logically explained.
7. The elements of subgroup of a given group have been placed separately.
8. It provides clear demarcation of different kinds of elements such as Active metals, Non – metals, Transitional metals, Metalloids, Lanthanides, Actinides and Inert gases.
9. It is easy to remember and reproduce.

Advantages of long form of periodic table in learning chemistry:-

1. The periodic table has made the study of chemistry of elements and their compounds systematic and easy.
2. If the properties of one of the elements of a group are known, then the properties of other elements of the same group are predicted.
3. The type of compound formed by an element can be predicted by knowing the position in the periodic table.
4. The periodic table has been useful to predict the existence of new elements.
5. Atomic masses of many elements have been checked and corrected on the basis of their properties in the periodic table.
6. A periodic table chart is used as a teaching aid in chemistry in schools and colleges.

Q Write down the characteristics of periods in long form of periodic table.

Ans. Some of the important properties and their variation on moving across a period are as under:

i) **Valence electrons**:- In a period from left to right , the number of valance electrons increases from 1 to 8 except in the first period where it increases from 1 to 2.

	3	4	5	6	7	8	9	10
2^{nd} period elements	Li	Be	B	C	N	O	F	Ne
Electronic configuration	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6	2, 7	2, 8
Valance Electron	1	2	3	4	5	6	7	8

ii) **Valance of elements:-** In a period, from left to right. The valancy of elements increases from 1 to 4 and then decreases to 0(Zero)

	3	4	5	6	7	8	9	10
2^{nd} period elements	Li	Be	B	C	N	O	F	Ne
Electronic configuration	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6	2, 7	2, 8
Valancy	1	2	3	4	3	2	1	0

iii) **Size of atoms**:-The size of atom is indicated in terms of radius of the atom. It is measure in angstrom units, where $1A^0$ is equal to 10^{-10}m.

On moving from left to right in a period of the periodic table, the size of atoms decreases.

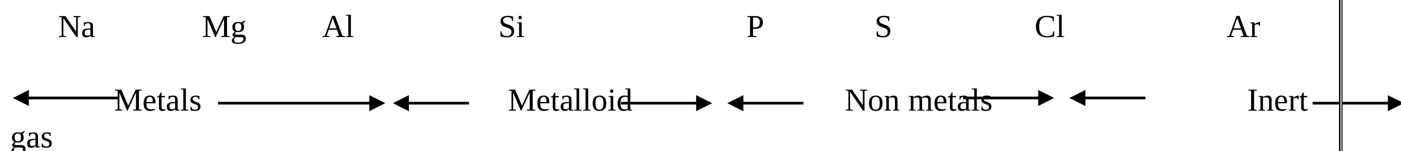
	3	4	5	6	7	8	9
2^{nd} period elements	Li	Be	B	C	N	O	F
Electronic configuration	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6	2, 7
Atomic radius in A^0	1.52	1.06	0.88	0.77	0.70	0.66	0.64

However, in case of Noble gases the atomic radius suddenly increases as compared to its predecessor.

iv) Metallic and Non-metallic character of elements:-

On moving from left to right in a given period the metallic character of the element gradually decreases while the non metallic character increases therefore, the typical metals are on the extreme left and typical non metals on the right side of the periodic table.

<u>Elements of 3rd period</u>

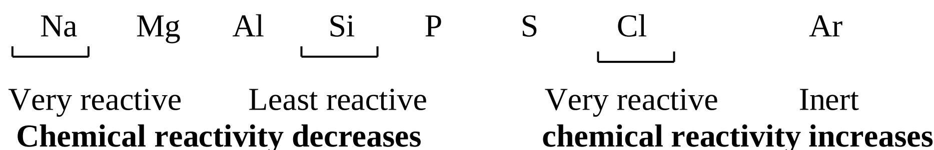


Na Mg Al Si P S Cl Ar

Metals | Metalloid | Non metals | Inert gas

Metallic character decreases
Non –metallic character increases.

v) **Reactivity of elements**:- On moving from left to right in a period, the reactivity of elements first gradually decreases and then gradually increases such that the last element in the zero period is chemically inert.



Na Mg Al Si P S Cl Ar

Very reactive | Least reactive | Very reactive | Inert

Chemical reactivity decreases **chemical reactivity increases**

vi) **Nature of oxides of elements:-** On moving from left to right in a period , the basic nature of its oxides gradually decreases and acidic nature of oxides gradually increases.

Third period elements	Na	Mg	Al	Si	P	S	Cl
Oxides	Na_2O	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl_2O_7
Nature of Oxide	Highly basic	Basic	Amphoteric	Slightly acidic	Acidic	More acidic	Highly acidic

<u>Basic nature of oxides decreases</u>
<u>Acidic nature of oxides increases</u>

Q Write down the characteristics of groups of long form of periodic table.

Ans. Some of the important properties and their variation on moving from top to bottom.

1) **Valance electron**:- On moving from top to bottom in a group the number of valance electron remains same.

Element	Electronic configuration	Valance electron
$_3$Li	2,1	1
$_{11}$Na	2 , 8 , 1	1
$_{19}$ K	2 , 8 ,8 ,1	1
$_{37}$ Rb	2 , 8, 18 , 8 , 1	1
$_{55}$ Cs	2 , 8, 18 , 18 , 8 , 1	1

All the elements of group 18 have 8 electrons each in their atoms, except helium which has only 2 valance electrons in its atom.

2) **Valancy of elements:-** As the number of electrons in the valance shell of a group remain same, therefore, all the elements in a group have the same valancy.

Group 1

Elements	Electronic Configuration	Valency
$_1$H	1	1
$_2$Li	2 , 1	1
$_{11}$Na	2, 8 , 1	1
$_{19}$ K	2, 8, 8 ,1	1
$_{37}$ Rb	2 , 8 , 18 , 8 , 1	1
$_{55}$ CS	2 , 8 , 18 , 18 , 1 , 8 , 1	1

Group 17

Element	Electronic Configuration	Valency
$_9$F	2 , 7	8 – 7 =1
$_{17}$ Cl	2,8,7	1
$_{35}$Br	2,8,18 ,7	1
$_{53}$ I	2 , 8 , 18 , 18 , 7	1
$_{85}$ At	2, 8 , 18 , 32 , 18 , 7	1

3) **Metallic Character:-** While going down in a group of metals (1 – 3) , the metallic character of elements increases the most metallic elements in a periodic table is francium.

Elements	**Symbol**	**Character**
Lithium	Li(3)	Least metallic
Sodium	Na (11)	Metallic Character increases ↓
Potassium	K(19)	
Rubidium	b(37)	
Caesium	CS(55)	
Francium	Fr (87)	Most metallic

4) **Non- metallic character:-** While going down the group (14 – 17) , the non metallic character of elements decreases. The most non-metallic element in fluorine in the periodic table.

Group 17 elements

Element	**Symbol**	**Character**
Fluorine	F(9)	Most non-metallic or most electro magnetic
Chlorine	Cl(17)	Non- metallic character decreases. ↓
Bromine	Br(35)	
Iodine	I(53)	
Astatine	At (85)	Least non- metallic Or Least electro-negative

5) **Chemical reactivity**:- While going down the group of metals (1 – 3) , the chemical reactivity increases.

Element	Symbol	Character
Lithium	Li	Least reactive
Sodium	Na	↓
Potassium	K	
Rubidium	Rb	
Caesium	Cs	
Francium	Fr	Most reactive

While going down in a group of non metals, the chemical activity decreases.

Element	Symbol	Nature
Fluorine	F	Most reactive
Chlorine	Cl	
Bromine	Br	
Iodine	I	Least reactive

6) Gradation of physical properties:- While going down in a group of metals, the physical properties, such as melting point , boiling point decreases gradually and while going down the group of non metals, the physical properties increases gradually.

Heredity And Evolution Bio.

Terminology

Character: It is distinct well defined morphological or physiological feature of an individual, e.g., height.
Trait: It is a character that a living being is able to pass into its young ones through reproduction. In asexually reproducing living beings characters are transmitted into young ones in unaltered form but in sexually reproducing living beings they are passed in altered as reshuffling takes place during meosis.
Gene: It is a unit of inheritance which forms the part of a chromosome. Genes are passed from parents to the offspring's through chromosomes present in the nuclei of the parent gametes.
Gene locus: It is the portion or region on chromosomes representing a single gene. The alleles of a gene are present on the same gene locus on the homologous chromosomes.
Alleles: An allele is a component of a Mendelian gene that governs a character. Alleles are defined as variable forms of a Mendelian gene situated at some locus in homologues chromatin threads.
Chromosomes: Filamentous bodies present in the nucleus, composed of chromatin material. (DNA-RNA protein complex)
Phenotype: External visible and observable characters of an collectively called phenotype. It is result of the interaction between genotype and environment e.g. tallness colour.
Genome: A complete set of chromosomes inherited as a unit from one parent is called a genome. A haploid contains a single genome while as diplocid cell has two genomes.
Homozygous: It is an individual having identical alleles of a gene, e.g., TT, tt.
Heterozygous/Hybrid: An individual having both alleles of a gene dissimilar i;e one dominant and one recessive allele for a particular character
Dominant gene: The gene which expresses itself in a heterozygous organism is called dominant gene.
Recessive gene: The gene which is unable to express its effect in the presence of the dominant gene is called recessive factor.
F_1 Generation: (First Filial or Son and Daughter Generation):- It is the generation of hybrids produced from a cross between genetically different individuals called parents.
F_2 Generation: F_2 or second filial generation is the generation of individuals which develops as a result of inbreeding amongst individuals of F_1 generation.
True Breeding: They are homozygous or genetically pure individuals which produce similar offspring. A strain of true breeding individuals is called pure line.
Genetics: (Gk. genesis-descend)
The Science which deals with the study of heredity and variation is known as genetics, the term 'Genetics' was coined by W.Bateson, in 1905.
Genotype:- Internal genetic constitution of an organisms is called its genotype. It refers to all the genes inherited by an individual from its parents(s) irrespective of whether they are expressed or not YY, Yy
Q Explain, how variations accumulate during reproduction?
Characters are passed from one generation to another but next generation shows variations from the previous one. The extent of variation depends on the type of reproduction.

- Organisms reproducing asexually have minor differences between them, which may appear due to small inaccuracies while DNA replicating or copying.
- Organisms showing sexual reproduction show more variations. Though off springs resemble their parents but their resemblance is never complete.
  Variations in different organisms may be advantageous or disadvantageous. Therefore chances of survival of these variations are not same. Selection of variations by environmental factors forms the basis of evolution.

Heredity: - Heredity can be defined as the transmission of characters in living beings from one generation to successive generations. A study of the mechanism of transfer of such characters comes under the science of genetics. The word genetics in Greek means 'to grow' or 'to become'.

Variation:- Though the children resemble their parents, they are not exact copies. They differ among themselves and also from their parents, except for identical twins, which show resemblance in many respects as they develop from the same zygote. The difference in the traits (characters) among the organisms of a species is called variation. It may be morphological, physiological and behaviouristic.

Variations are of two types

i) **Environmental variations**:-These are due to food, temperature or other external factors.

ii) **Hereditary variation: -** These are due to genetic differences.

A. Gregor Johann Mendel was born in a gardener's family in 1822 and received his early education in the village. Mendel entered Augustinian Monestry at Brunn in Austria as priest. There, he conducted experiments for about nine years on the common garden pea plant, pisum satioum.

Mendel was the first to explain the mechanism of transmission of characteristics from the parent to the offspring, generation after generation. He was the first to introduce the concept of gives as the basic unit of heredity.

Unfortunately, his outstanding contributions were overlooked by the scientific world of that time because;

i) The results were published in an observe journal.

ii) Scientists were busy in Darwin's theory of origin of species thus they failed to notice his work. Scientists were ignorant about cytological basis of heredity.

(1)Mendel and his work:- The Austrian monk Gregor Johannes Mendel was the first

- to explain the mechanism of transmission of characters from parents to the offspring's, generation after generation.
- to introduce the concept of genes as the basic unit of heredity. Mendel used the term 'factors' in place of 'genes'.

  He is considered to be the pioneer of modern genetics and is called 'father of Genetics'.

(2)Mendel's Experimental Laboratory And Material:- Mendel's experimental use of the garden pea (Pisum sativum) was evidently not an accident but the result of his careful observations and thoughts. He observed the following advantages in selecting pea plant.

i) Garden pea plant has a short life cycle. It makes possible to study several generations within a short period.

ii) Garden pea plant shows several well defined easily detectable contrasting traits.

iii) Pea flowers are bisexual, male and female reproductive organs mature at the same time and complete enclosure of reproductive parts by petals ensure self pollination.

iv) Artificial cross pollination (hybridization, i.e. removal of stamens with pollen grains of desired plants) can be easily achieved as reproductive organs are large enough to be seen with naked eyes.

v) Pea plants having each of the seven traits Mendel selected were readily available.

vi) Pea plants can be raised maintained and handled conveniently.

vii) Pea plants produce large number of seeds in one generation. This help in drawing authentic conclusions.

(3).Mendelian Traits:

Character	**Dominant Trait**	**Recessive Trait**
Seed Shape	Round	Wrinkled
Seed Colour	Yellow	Green
Flower Colour	Violet	White
Flower position	Axial	Terminal
Pod Shape	Inflated	Constricted
Pod Colour	Green	Yellow
Stem height	Tall	Dwarf

(4)Mendel's Experiment:- Mendel performed separate crosses involving traits of one contrasting character, two and three contrasting characters. These crosses were respectively called monohybrid, dihybrid and trihybrid cross.

- **Monohybrid Cross: -** Crosses which were made to study the inheritance of one pair of contrasting characters by Mendel are known as monohybrid crosses.

  In one such cross, Mendel selected two sets of pea plants with contrasting characters for height. One set of pea plant was about 6// (six feet) in height and the other set was of short plants with an average height of 1// (one foot) Mendel called these plants homozygous tall and homozygous dwarf. These were called as pure strain.

  Mendel cross-pollinated homozygous tall plants with homozygous dwarf plants. These plants represented the parent generation (p- generation).

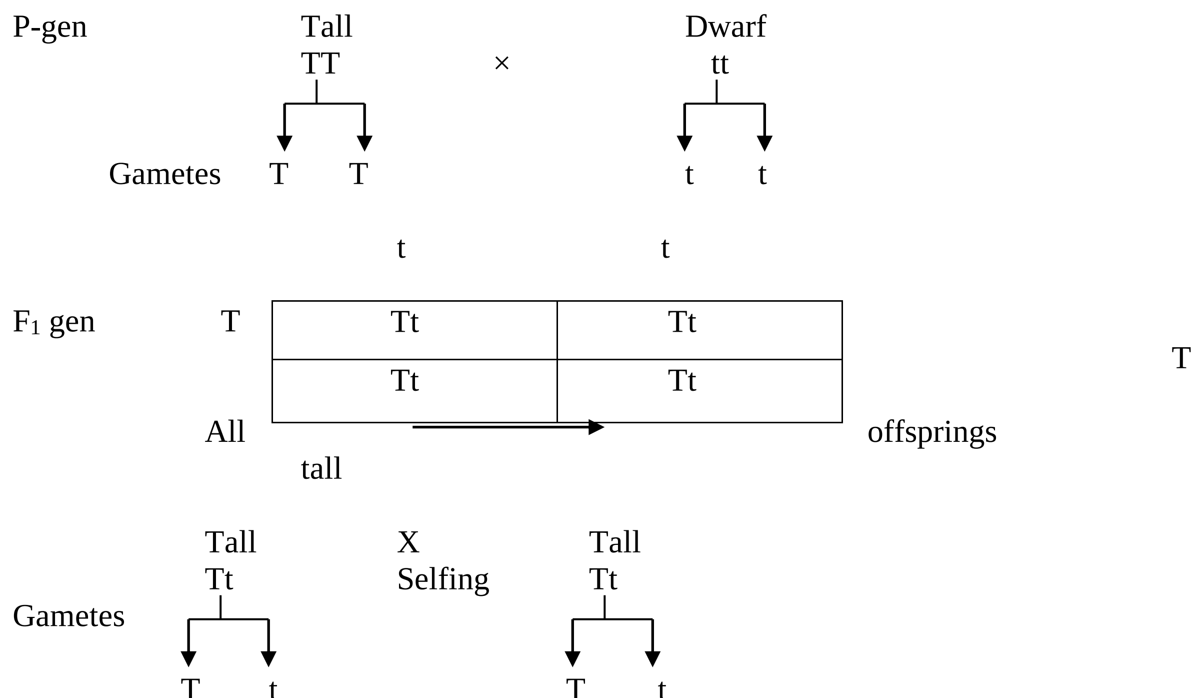
  The pollen grains were collected from a flower of tall plant and dusted over the pistils of emasculated flower of dwarf plant (vice- versa, reciprocal cross would not make any difference in the results). Care was taken that the plants of P generation do not get self Pollinated. After cross pollination, the flowers were covered with bags.

  The plants grown from the seeds of parental plants were hybrid plants; these belonged to the F_1 generation or first filial generation. All plants of F_1 generation were tall.

  The plants of F_1 generation were self pollinated and seeds were collected. The plants raised from these seeds belonged to second filial generation or F_2 generation.

  Mendel observed that among the plants of F_2 generation, 75% were tall and 25% were dwarf, i.e. tall and dwarf plants were produced in the ratio 3: 1.

  F_2 plants were self pollinated to produce F_3 generation. Mendel observed that dwarf plants (25% of F_2 generation produced only dwarf plants. Of the F_2 tall plants (75%), only 25% produced tall plants on self pollination. These were called pure tall or homozygous tall plants whereas 50% produce tall and dwarf in the ratio 3: 1 on self pollination. These were called hybrid tall plants.



	T	t
T	TT	Tt
t	Tt	tt

F_2 gen.

TT – 1 } Tall
Tt – 2 }
tt – 1 Dwarf

Phenotypic ratio : Tall: Dwarf
3 : 1

Genotypic ratio : TT : Tt : tt
TT : Tt : tt
1 : 2 : 1

B .Dihybrid Cross:-

When in a cross, two pairs of contrasting characters are considered at a time, than such cross is known as dihybrid cross. Example, cross between two pea plants with round yellow and green wrinkled seeds.

Mendel performed many crosses and in one cross between round- yellow seeds and wrinkled green seeds, he found that only round-yellow seeds were produced in the first generation, the seeds (round – yellow) produced as a result of cross pollination of p-generation plants belongedtoF_1generation. When the F1 generation pea plants were self pollinated by Mandel, then four types of combinations of shape and colour were observed in second generation or F2 generation. These are

i)	Round yellow	9	Parental combination
ii)	Round green	3	New combination
iii)	Wrinkled yellow	3	
iv)	Wrinkled green	1	Parental combination

thus the offsprings of F_2 generation were produced in the ratio of 9 : 3 : 3 : 1. This ratio is called dihybrid ratio.

C.	Parental generation	Round yellow	Wrinkled green
	Factors	R R Y Y	r r y y
	Gametes	RY RY	ry ry
	Fusion of gametes	RrYy RrYy	R rY y RrYy

RY Ry rY ry → Male gametes

RRYY Round yellow	RRYy Round yellow	RrYY Round yellow	RrYy Round Yellow
RRYy Round yellow	RRyy Round green	RrYy Round yellow	Rryy Round Green
RrYY Round yellow	RrYy Round yellow	rrYY Wrinkled yellow	Rryy Wrinkled Yellow
RrYy Round yellow	RRyy Round green	rrYy Wrinkled yellow	Rryy Wrinkled Green

Thus in F_2 generation

Phenotypic ratio: Round Yellow = 9 ; Round Green = 3
Wrinkled Yellow = 3 ; Wrinkled Green = 1

Genotypic ratio

RRYY : RrYY : RRYy : rrYY : RrYy : rrYy : RRyy : Rryy: rryy
1 : 2 : 2 : 1 : 4 : 2 : 1 : 2 : 1

Interpretations Made By Mendel: - Mendel on the basis of his observations of different crosses, made the following conclusions:-

i) F_1 offsprings always exhibited only one of the parental forms of a trait and not the other (This was true for reciprocal crosses as well).
ii) Trait which was hidden in F_1 generation appeared in F_2 generation. In F_2 generation both the parental traits appeared. Mendel termed the form of the trait expressed in F_1 generation as dominant trait and other which was hidden as recessive trait.
iii) Mendel observed a difference in the behaviour of plants raised from F_2 offsprings with dominant form of a trait. Only $1/3^{rd}$ of F_2 plants with dominant trait were true breeding, rest two- thirds of plants were not true breeding and resembled the F_1 hybrid plants in their behaviour.
iv) Mendel observed that one of the parental forms of the trait was always absent in F_1 hybrid but reappeared unchanged in the F_2 generation. It proved that alternate forms of a trait can retain their identity in the hybrid and can re-emerge unchanged in subsequent generations.
v) In dihybrid crosses, Mendel observed four types of plants in F_2 generation. He concluded that the factors of each of two characters assort independent of each other.

Mendel's Principles Of Inheritance:- The above observations led Mendel to formulate the following postulates or principles of heredity:

i) **Principle of Dominance (Postulate 1) :-** In a hybrid or heterozygous individual two dissimilar unit factors are present for one character. Out of two factors (genes) only one is able to express itself and it prevents expression of the other. The one which expresses itself is called dominant gene or factor and the one which remains unexpressed is called recessive factor or gene. For example, in hybrid tall (Tt) only unit factor (gene) of tallness expresses itself, hence it is called dominant. The unit factor (gene) for dwarfness fails to express itself, hence it is called recessive.

ii) **Principle Of Segregation (Postulate 2):-** The two unit factors of a character which remain together in an individual do not get mixed up, or get contaminated and keep their distinct identity. They separate or segregate during gamete formation so that each gamete receives only one factor (gene) for each character and is always pure. This postulate is also called "Principle of purity of gametes".
For example, in a hybrid tall pea plant, unit factors of tallness (T) and dwarfness (t) separate out or segregate out during gamete formation. The two unit factors occur with equal frequency in male and female gametes.

iii) **Principle Of Independent Assortment (Postulate 3):-**This principle states that the unit factor of each character is assorted or distributed into the gametes independently of the unit factors (genes) of only other character and gets randomly rearranged in the offspring. For example, in Mendel's dihy brid cross, the offspring of F_1 generation on self breeding produced four types of off springs. Two types were similar to parents while the remaining two types had combination of traits. This became possible because the unit factors of the two characters assorted independent to each other.
iv)

Q. Explain how blood groups are inherited.

Ans. Human population has four blood groups A, B, AB and O. This blood group system is controlled by a gone which has three different forms denoted by I^A , I^B and I^o. The genes I^A and I^B are dominant over gene I^o but are codominant to each other. Although there are three genes for blood, but anyone person can have only two of them.

1. If a person homozygous for blood group A marries a woman with blood group O or vice versa, all her children will have blood group A.
2. If a person homozygous for blood group B marries a woman with blood group B marries a woman with blood group O or vice versa, all her children will have blood group B.
3. If a man homozygous for blood group A marries a woman homozygous for blood group B, all their children will have blood group AB since IA and IB are codominant.
4. If a man heterozygous for blood group A (I^AI^o) marries a woman for blood group B (I^BI^o) their children will have blood groups of the types
   A , B , AB and O.
5. If a man with blood group AB (I^A I^B) is married to a woman with blood group AB (I^AI^B), then their children will have blood groups of the following types:

   25 % – AA
   50 % – AB
   25 % – BB

Q What is the importance of Mendelism?

Ans Following are points which illustrate the importance of Mendelism:

Improvement of plants: Hybridization is used for obtaining improved varieties of plants. This process results in combinations of desirable characters of two or more species or varieties. In other words, desirable characters of one species are transferred to the other.

Improvement of animals: - Mendelism has enabled the plant breeders to improve the races of domestic animals. Hybridization through artificial insemination has proved highly successful in improving the quality of milk, egg and other animal products.

Improvement of human race: - Laws of heredity postulated by Mendel are equally applicable to mankind.

Disputed parentage:- Study of inheritance of the blood group can solve the disputed parentage of a child.

Genetic counseling:- With the knowledge of Mendelism, genetic counselor can predict the possibility of hereditary defect in a future (unconceived child) and even detect genetic disorders in early foetus.

Q How do traits get expressed?

Ans. Inheritance of traits is controlled by genes. Genes are located on the chromosomes. Each gene is composed of DNA. A section of DNA carries information for a particular type of protein to be synthesized. The protein may be an enzyme which controls appearance of a particular character.

Let us take the example of inheritance of tallness in plants. The height of a plant depends upon the amount of growth hormone. Gene for tallness carries the information for synthesis of efficient enzyme which in turn produces more amount of hormone which leads to greater height of a plant. On the other hand if a plant has both alleles for dwarfness then less efficient enzymes will be produced which in turn will synthesize less amount of hormone and the plant will remain dwarf.

Q. How is sex determined in human beings?

Ans: Sex chromosomes determine the sex in human beings. In males there are 44+XY chromosomes, whereas, in females there are 44+XX. 44 represent autosomes and X and Y chromosomes determine the sex in human beings. The sex chromosomes separate at meiosis just as the other chromosomes (autosomes). Thus, two types of sperms are formed in males. One type (50%) will be having X chromosome; the other type (50%) will be having Y chromosome. In females, gametes (ova) are of one type and contain X chromosome. Thus, females are homogametic.

The sex is established at the time of fertilization. If male gamete having Y-chromosome undergoes fusion with female gamete having X-chromosome, the zygote will have XY chromosome and this gives rise to a male child. If male gamete having X-chromosome undergoes fusion with female gamete having X-chromosome, the zygote will have XX chromosome and this gives rise to a female child.

Evolution

The word 'evolution' (α - evolvere) means 'to unfold or unroll' or to reveal hidden potentialities. In its broadest sense, evolution simply means an orderly 'change' from one condition to another. According to Spencer, evolution is a kind of gradual formation of the new organism from the pre-existing primitive organism through slow and steady changes. The changes occur due to accumulation of variations.

Darwin's Theory Of Evolution:

The theory states that organic evolution occurs through natural selection and accumulation of inheritable variations which provide structural and functional superiority to some individuals over others in their survival reproduction. The important features of the theory are as follows:

Over-Production:- All organisms produce much more offsprings than can actually survive. A fern plant may produce 50 million spores, and an insect like a housefly may lay thousands of eggs.

Limited Food and Space: - There is limitation of food and space on earth. Therefore, populations of different species cannot increase beyond a certain limit.

Struggle for Existence: - There is a competition amongst organisms to obtain optimum resources. The competition is maximum amongst members of the same species, i.e., intraspecific competition.

Variations:- A large number of variations occur in size, structure, physiology and behavior of individuals of a species. The variations are of three types- useful, neutral and harmful.

Natural Selection (Survival of the Fittest):- In the struggle for existence, only those individuals survive and reproduce which have the most useful variations.

Inheritance of Useful Variations: - Individuals with useful variations reproduce and transfer the variations to the next generation. Next generation repeats the process of formation of new variations and natural selection. There is, therefore, a continuous selection.

Formation of New Species: - Accumulation of variations produces a completely new species.

Neo- Darwinian Theory:-

The modern version of Darwin's theory is called the neo- Darwinian Theory. Its postulates are as follows:

a) Organisms produce more offspring that can possibly survive. All sexually reproducing species produce surplus offsprings most of which die before reaching sexual maturity.
b) Variations occur in organisms, which affect their survival. The source of variation may be sudden changes in the genes or chromosomes (mutations), Gene mutations are chance alterations in the sequence of DNA coding for proteins. Mutation may be damaging or beneficial to the organism, leading to the synthesis of new proteins or proteins with improved characteristics.
c) Natural selection keeps species adapted. The organisms, which are best adapted, are the ones which are most likely to survive. This process is called natural selection and ensures adaptation of species to their environment.
d) New species arise by isolation. New species arise when a population of a species are separated and isolated so that they do not interbreed. The separated population adapts to their own particular environment and may diverge, eventually forming a new species.

Evidences Of Organic Evolution:- Convincing proof in support of organic evolution have been drawn from the study of different branches of biology.

- Evidence from palaeontology
- Evidence from morphology and functional anatomy.
- Evidence from embryology.
- Evidence from bio-geography.
- Evidence from molecular biology.

Evidence From Paleontology:- Paleontology is the study of fossils (dead remains of the past life seen as impressions or hard parts) of animals and plants of past geological ages.

The fossils provide a direct proof of evolution,

i) The ancient fossils present in bottom rocks are simple while the most recent fossils found in the upper strata are most highly evolved.

ii) A few fossils are found to be intermediate in their structure exhibiting features of groups of living organisms e.g. Archaeopteryx, a fossil of a bird which also shows certain reptition features. Thus it is a missing link between reptiles and birds and suggests that birds have evolved from reptiles.

iii) By the study of fossils, the complete evolutionary history of some elephant, man, etc. could be traced.

Fossil evidence indicates that the horse has undergone considerable evolutionary change over a period of 60 million years. The horse evolved from a dog sized, five toed browsing animal to a large one toed grazer. Few important stages are:-

Eohippus (Eocene)
Mesohippus (Oligocene)
Merychippus (Miocene)
Pliohippus (Pliocene)
Equus (Pleistocene and recent epochs).

Evidence from morphology and functional anatomy:

Homologous Organs: (Owen 1843) The organs of different species which look different and perform different functions, but have the same basic structure and similar embryonic origin are called homologous organs. The homologous organ was coined by Richard Owen. Let us compare the forelimbs of frog, lizard bird and human. They appear quite different externally. In frog, the for limbs take part in absorbing shock at the time of landing after a leap. In lizard, they help in creeping. In birds they take part in flying. In human begins they are involved in grasping. The forelimbs of all these animals have a similar basic plan of structure.

Analogous Organs: (Owen 1843). The organs which have the same function and are superficially alike but quite different in fundamental structure and embryonic origin are called analogous organs. Wings of insects, bats and birds perform the same function of flight. They have a nearly similar appearance. However, the wings of these three types of animals are structurally quite different.

Vestigial Organs: - The organs which are present in reduced form and do not perform any function in the possessor but are fully developed and functional in related animals are called vestigial organs. e.g. tailbone, wisdom tooth, body hair in male ear muscles, vermiform appendix.

Evidence From Embryology: - The study of embryos of fish, frog, tortoise, pigeon, rabbit and man during their early stages of development reveals that the development pattern is same. They appear to be alike and it is even difficult to distinguish them. This similarity in the embryo of divergent forms of vertebrates indicates their common ancestry.

Evidence From Molecular Biology:-

All of the various types of proteins in living organisms are made of only twenty kinds of amino acids. Despite the great diversity of life on our planet, the simple language of the DNA code is the same in all living things. This is evidence of the fundamental molecular unity of life.

Q Define a species.

Ans. A species is a group of individuals, having some similar basic characters, distinct from other groups of individuals, interbreeding under natural conditions to produce fertile offspring and sharing a common gene pool. So the basic characteristic of a species is that it is a reproductively isolated unit, the members of which can interbreed among themselves but not with the members of other species.

A species is formed of large number of populations, called sister-populations, living in different geographical areas but their members are not reproductively isolated though the chances of their

interbreeding are less than those within same population. Within a geographical area, a population is not uniformly distributed and is sub-divisible into two or more sub-populations called demes, which have highest chances of interbreeding. Due to sexual communication, there is free flow of genes between the members of a species, though their chances are maximum within a deme than between the demes while these are least between the members of sister populations.

Q Define speciation. Explain how speciation occurs.

Ans. The process by which new species develop from the existing species is known as speciation. New species are formed when the population of same species splits into two separate groups which then get isolated from each other geographically by the barriers such as mountain ranges, rivers or the seas. The geographical isolation of the two groups of population leads to their reproductive isolation due to which no genes are exchanged between them. However, breeding continues within the isolated population producing more and more generations. Over the generations the processes of genetic drift and natural selection operate in different ways in the two isolated groups of population and

make them more and more different from each other. After thousands of years the individuals of these isolated groups of population become so different that they won't be capable of reproducing with each other even if they happen to meet again.

Q. What are acquired traits?

Ans. Acquired traits are the traits which are acquired by organisms in the life time. Acquired traits are, therefore, not inheritable. They disappear with the death of the individual, e.g., muscular body of an athlete, learning of music.

Q. What are inherited traits?

Ans. Inherited traits are those traits which are controlled by specific genes and are passed on from one generation to next generation. Any alteration in the genes will be inherited to next generation through germ cells and will cause variation.

Q. Explain the origin of life by chemical evolution as suggested by Oparin and Haldane.

Ans. Life originated on earth through chemosynthesis or formation and coming together of biochemicals. It is called naturalistic theory or theory of chemical origin of life. The theory was given by Russian scientist Oparin (1924) and British turned Indian scientist J.B.S. Haldane (1929). At the time of formation of earth lighter elements interacted and formed water (H_2O), methane (CH_4), ammonia (NH_3), molecular hydrogen (H_2) and carbon dioxide (CO_2). They formed a reducing hot atmosphere of earth. It was exposed to ultraviolet radiations, cosmic rays, lightning and hot lava from volcanoes. Methane, ammonia, hydrogen and other molecules interacted and formed sugars, amino acids, alcohols, fatty acids, nucleotides and other biochemicals. With further interactions and polymerization, complex organic molecules were formed. Their aggregation formed coacervates or colloidal complexes that developed covering membrane and nucleic acids to produce protocells or primitive cells.

QWhat are Fossils?

Ans. Fossils (L. fossils-dug up) are the remains or impressions of the hard parts of the past organisms in the strata of the earth. They occur in sedimentary rocks, lava and snow. Branch of biology that deals with the study of fossils is called paleontology. Fossils provide a direct evidence of evolution. They are often called written documents of evolution. Fossil record shows that different types of organisms appeared at different times. Many of them became extinct later on but some continued to live in same or modified form. Fossil history of some animals like horse has been discovered. How birds arose from reptiles has also been found out with the discovery of fossil Archaeopteryx. Prior to Archaeopteryx feathers had evolved from protecting some reptiles from cold.

Fossils of prokaryotes have been found in older rocks than those of eukaryotes. Invertebrates were formed before vertebrates. In vertebrates fishes appeared earlier than amphibians, amphibians earlier than reptiles, reptiles earlier than birds and mammals. This is how evolution has occurred.

Q. How are fossils formed?

Ans. Formation of fossils is called fossilization. Most of the fossils are found in sedimentary rocks, which develop at the bottom of deep lake and sea. Dead bodies of terrestrial plants and animals are brought here by streams, rivers and rain wash. Along with dead bodies of aquatic organisms, they settle down at the bottom where the rate of decay is slow due to absence of oxygen. Sand and silt settle over the dead bodies. Slow decay continues, it leaves only hard parts. Impressions, moulds and casts may be produced if there are no hard parts. Fossils are not necessarily formed in the sedimentary rocks. Land organism have been found preserved in amber (hardened raisin), asphalt (hardened tar), ice, volcanic ash and even in sand dunes

Q. Evolution by Stages

Ans. There has never been an evolution of an organ from a single DNA change or mutation. It is because organs are complex and are genetically controlled by a number of genes. Therefore, evolution of new organs always occurs in stages. To understand evolutionary stages let us think about origin of some organs.

The most primitive eyes developed in flatworms, e.g., Planaria (=Dugesia). They are eye spots which are photosensitive. The eye spot help the animals to be aware of the environment. In insects both simple eyes as well as compound eyes evolved. Compound eyes give mosaic vision. Perfect eyes developed in molluscs , e.g., Octopus have all the components of vertebrate eye but the origin is quite different, i.e., from skin. In vertebrates an eye develops from two different germinal layers (ectoderm and mesoderm). It is clear that the eye has evolved through different pathways and different intermediate stages in different groups. The intermediate stages were useful to the animals in making them aware of the surroundings.

Limbs have evolved from swimming paddles formed from lobed fins of the lung fishes. Wings have been formed by modification of fore-limbs that were covered by feathers. Feathers evolved in dinosaurs for providing insulation during cold. In members of the Dromaesaur family of small dinosaurs, feathers have been found to be present all over the body as well as over the fore limbs. These feathered fore-limbs helped the small dinosaurs in longer jumps, followed by gliding and then flying with the conversion of fore-limbs into wings.

Q. What is the role of DNA changes in determining evolutionary relationship?

Ans. Every mutation or change in trait is caused by change in the DNA representing a gene. All the changes that an organism has undergone in its evolution is represented in the form of changes in DNA. Comparison of DNA of two species can indicate the different changes in their DNA during their evolution. The method is used in determining evolutionary relationship of different organisms.

Q. Why should evolution not be equated with progress?

Ans. Evolution should not be considered equal to progress. It means generation of diversity and their adaptation according to their environmental needs. It is not necessary that one species has to get eliminated to give rise to new one. Moreover it is not necessary that newly emerged species is better than the older one.

Q. Name the tools which have been used to trace various steps of human evolution.

Ans. Human evolution has been studied by using various tools of tracing evolutionary relationships like excavating (digging earth) carbon dating, studying fossils as well as determining DNA sequences. The study reveals there is a great diversity of human forms and features across the planet. Infact all human beings belong to single specie Homo sapiens. The earliest members of Homo sapiens have been traced back to Africa.

A couple of hundred thousand years ago, some of our ancestors left Africa while others continued living there while the residents spread across Africa. The migrants slowly spread across the planet from Africa to west Asia, and then to Central Asia, Eurasia, South Asia. They travelled down the islands of Indonesia and the Philippines to Australia, and they crossed the Bering land bridge to the America. They went forwards and backwards, with groups sometimes, separating from each other, sometimes coming back to mix with each other, even moving in and of Africa. Like all other species on the planet, they had come into as an accident of evolution and were trying to live their lives the best they could.

In –Text Questions

Q#1 If a trait A exists in 10% of a population of an asexually reproducing species and a trait B exists in 60% of the same species, which trait is likely to have a arisen earlier?

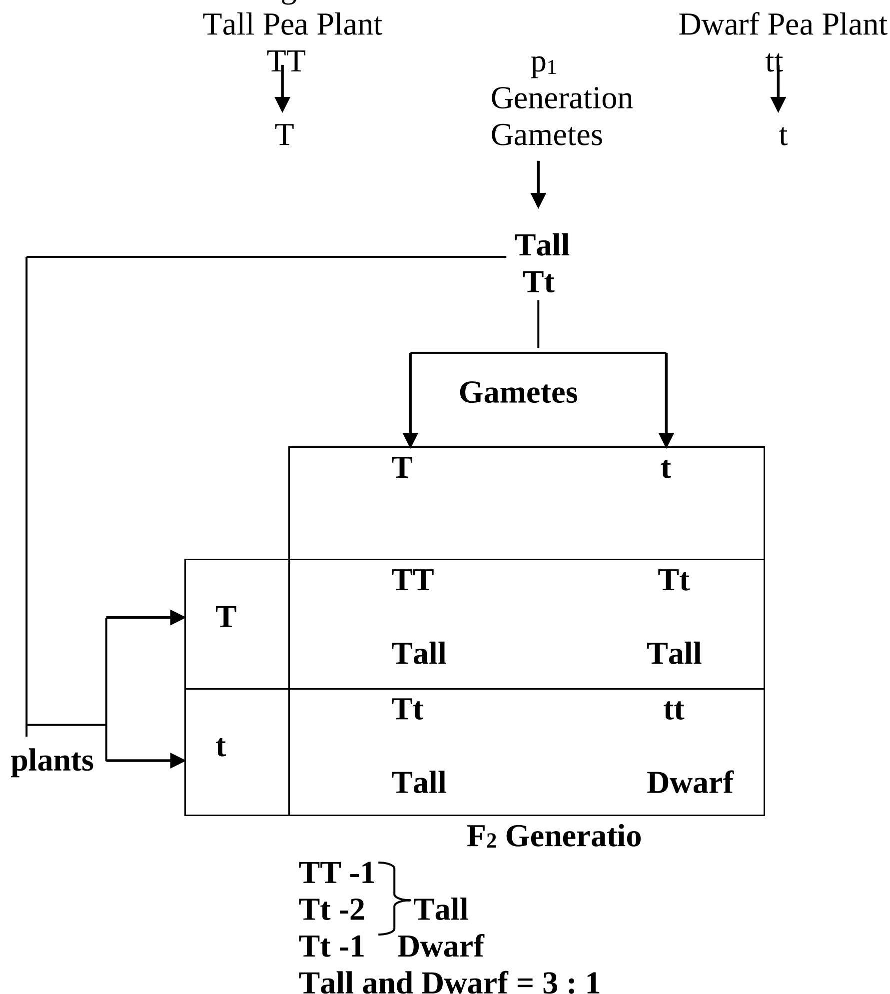
Ans. In asexually reproducing population, there is no reshuffling of traits. New traits do develop due to small inaccuracies produced during DNA copying. They will be in smaller proportion than the traits already present. Therefore, trait B which exists in 60% of population must have arisen earlier than the trait A which occurs in 10% of the population.

Q#2 How does creation of variation ns in a species promote survival?

Ans. A number of different types of variations develop in a population. All of them do not have survival value. However, some of them are pre-adaptations which can be beneficial under certain environmental conditions. For example, in a heat wave most of the bacteria will die but a few having pre-adaptation or variation to tolerate heat wave will survive and multiply. Actually selection of variants by different environmental factors constitutes the basis for evolution.

Q#3 How do Mendel's experiments show that traits may be dominant or recessive?

Ans. Mendel crossed Garden Pea plants having contrasting visible characters, e.g., tall and dwarf, violet and white flowered. In F_1 generation there were no halfway characteristics. A cross between pure tall and pure dwarf plants yields only tall plants in F1 generation. There were no medium height plants. When F_1 plants were self bred, the F_2 plants were not all tall plants appeared in ratio of 3 : 1. It means that the character of dwarfness was present in F_1 generation but was not expressed while the character for tallness expressed itself. The character which expresses itself in the presence of its contrasting form is called dominant. The other characteristic which is unable to express its effect in the presence of its contrasting trait is known as recessive.



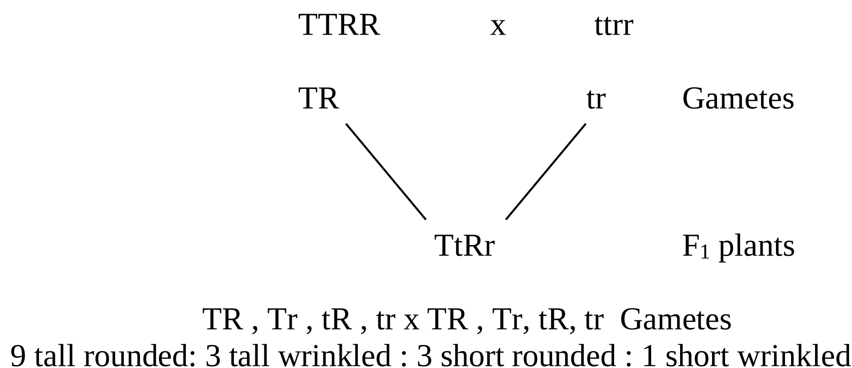
F_2 Generatio

TT -1
Tt -2 } Tall
Tt -1 Dwarf
Tall and Dwarf = 3 : 1

Mendels's explanation of monohybrid cross between tall and dwarf pea.

Q#4 How do Mendel's experiments show that traits are inherited independently ?

Ans. Independent inheritance of traits is proved by employing dihybrid crosses and obtaining dihybrid ratios. Mendel crossed pure breeding tall plants having round seeds (TTRR) with pure breeding short plants having wrinkled seeds (ttrr). The plants of F_1 generation were all tall and with rounded seeds (TtRr) indicating that the characteristics of tallness and round seededness were dominant. Self breeding of F_1 yielded plants with characteristics of 9 tall round seeded, 3 tall wrinkled seeded, 3 short round seeded and one short wrinkled seeded. Tall wrinkled seeded and short round seeded plants are new combinations which can develop only if the traits are inherited independently. If the two traits are considered individually, F_2 ratio would be same as for monohybrid crosses, i.e., 12 tal : 4 short, 12 round seeded: 4 wrinkled seeded.



TR , Tr , tR , tr x TR , Tr, tR, tr Gametes
9 tall rounded: 3 tall wrinkled : 3 short rounded : 1 short wrinkled

Q#5 A man with blood group A marries a woman with blood group O and their daughter has blood group O. Is this information enough to tell you which of the traits- blood group A or O, is dominant? Why or why not?

Ans. No. The information is not enough to tell whether the trait of the blood group A (I^A) or blood group O (I^0) is dominant. Either can be possible. Each individual carries two alleles. A recessive character appears only when the two alleles are similar.

Possibility 1. Blood Group A is dominant and O Recessive. The trait of blood group O can appear only when both the recessive alleles occur together as in mother and daughter (I^0I^0). A group father should carry both the alleles of A and O ($I^A I^0$).

Possibility 2. Blood Group O is Dominant and A Recessive:- In this case the father should carry the alleles of A (I^AI^A) while the mother can be homozygous or heterozygous (I^0I^0, $I^0 I^A$). The daughter will have one dominant alleles of O (I^0I^A).

As both the possibility can occur, the given information is unable to tell whether alleles for blood group A or O is dominant.

Q#6 How is the sex of the child determined in human beings?

Ans. Sex of the child is determined by the gametes that fuse to form zygote which later grows into offspring. Human females (44+XX) produce only one type of ova (22+X). Human males(44+XY)form two types of sperms, androsperms (22+Y) and gynosperms (22+X).Both are formed in equal number. It is a chance factor whether and androsperms or a gymnosperm fuses with egg to form 44 + XY or 44 +XX child. A child that obtains an X-chromosomes from father will be girl and the one who inherits a Y-chromosome will be boy.

Q#7 What are the different ways in which individuals with a particular trait may increase in a population?

Ans. There are three different ways in which individuals with a particular trait can increase in a population.

1. **Survival Value:-** The trait has survival value. It is picked up by natural selection. Through differential reproduction, it increases in population, e.g., green colour in beetles instead of red providing camouflage in bushes against being picked up by crows.
2. **Genetic Drift:-** There is seasonal or accidental decline in population. The survivors have certain combination of traits which increase in number with the increase in population. The traits may not give any extra benefit to population.
3. **Food:-** Individuals with particular trait may have extra abundance of food in their environment. They will naturally increase in number.

Q#8 Why are traits acquired during the life time of an individual not inherited?

Ans. Acquired traits are structural, functional and behavioral changes that an individual develops during its life time due to a particular environment, disease, trauma, use and disuse, conditioning or learning. The traits are not passed on to DNA of germ cells. They remain restricted to somatic cells. They are destroyed with the death of the individual. Therefore, intelligence, experiences and structural acquired changes cannot pass to the progeny. Weismann (1892) cut the tails of mice for 21 generations but a tail still developed in 22^{nd} generation.

Q#9 Why are the small number of surviving tigers a cause of worry from the point of view of genetics?

Ans. A small population is always at a risk of degeneration and extinction due to (i) Excessive inbreeding that brings about inbreeding depression or degeneration.(ii) Fewer recombination's and variations which are essential for maintaining vitality and vigor of the species.(iii) Lesser adaptability to changes in the environment. (iv) Increased threat to survival due to poaching, habitat destruction and environmental change.

Q#10 What factors could lead to the rise of a new species?

Ans.
(i) Absence of gene flow amongst subpopulations due to the presence of physical barriers, long distance, differences in habitats, environmental and climatic conditions.
ii) Accumulation of different variations in the different sub-populations of the species.
iii) Natural selections of particular traits in a particular environment.
iv) Genetic Drift: Separation of a small population, changes in its allele frequency, new mutations and adaptations to new habitat.
v) Reproductive Isolation:. Accumulation of different variations and genetic drift result in absence of interbreeding in the previous subpopulations of a species. This results in the formation of a new species.

Q#11 Will geographical isolation be a major factor in the speciation of an organism that reproduces asexually? Why or why not?

Ans. No. Geographical isolation has little role in speciation of self pollinating plant species because there is already no gene flow among members of the species.

Q#12 Will geographical isolation be a major factor in the speciation of an organism that reproduces asexually? Why or why not?

Ans. Recombination of genes is absent in asexually reproducing organisms. Therefore, variations originating in them do not get diluted but spread to all the subsequent generations. Geographical isolation, which helps in speciation due to formation of a separate gene pool, has no role in speciation of sexually reproducing organisms.

Q#13 Give an example of characteristics being used to determine how close two species are in evolutionary terms.

Ans. (i) Closeness of species is determined by presence or absence of fundamental characteristics and correlated characters. Two species of bacteria are closely related as they possess fundamental similarities of occurrence of nucleoid (instead of nucleus), absence of membrane covered cell organelles and presence of 70 S ribosomes. Human beings are close to monkeys because they possess similar eukaryotic multicellular body with vertebrate characters, mammalian traits and primate characters.

(ii) These days DNA matching is undertaken to find out the degree of closeness of the species.

Q#14 Can the wing of a butterfly and the wing of a bat be considered homologous? Why or why not?

Ans. No. Wings of butterfly and bat are fundamentally different in their origin and structure. In butterfly they are integumentary outgrowths having hollow tubes. In bat they are modified fore limbs which are covered by skin. Such organs which have a different origin and basic structure but are fundamentally similar are called analogous organs.

Q#15 What are fossils? What do they tell us about the process of evolution?

Ans. Fossils are remains or impressions of the past organisms that are found in the rocks of the old ages. They are often called written documents of evolution because they directly indicate the presence of different types of organisms in different ages. The path of evolution is known by arranging the fossils in a proper sequence age-wise. The early fossils are of simple organisms. Later on different complex forms arose, flourished and died down. They were replaced by newer forms. Study of fossils can also indicate the evolutionary stages of organisms. For example, modern horse (Equus) arose from a fossil animal Eohippus that existed on earth 60 million years back as a 30 cm high small animal. It evolved into 60 cm high goat sized Mesohippus about 40 million years back. Mesohippus gave rise to Merychippus (16 – 18 million years back) that formed Pliohippus (100 – 120 cm high, 10 million years ago). The modern horse evolved only 0.5 million years ago from Pliohippus.

Q#16 Why are human beings who look so different from each other in terms of size, colour and looks said to belong to same species?

Ans. Delimitation of a species is based on the presence of a common gene pool, free inbreeding and reproductive isolation. Differences in size, colour and looks are based on preponderance of specific alleles and their interactions with the environment. All human beings, despite presence of different races, belong to same species (Homo sapiens) because they share the same gene pool can marry amongst themselves and produce fertile offspring.

Q#17 In evolutionary terms, can we say which among bacteria, spiders, fish and chimpanzee have a better body design? Why or why not?

Ans. A better body design in the one which has more complexity, more elaboration and more controls which gives the organism a better competitive edge over others. There is no doubt that out of the four (bacteria, spiders, fish and chimpanzee), chimpanzee has a more elaborate body design or organization. However, since body design is meant for competitive survival in their environment, all the four organisms or for that all living organisms, having a good body design that is suited to their environment.

Chapter End Exercises

Q#18 A Mendelian experiment consisted of breeding tall Pea plants bearing violet flowers with short Pea plants bearing white flowers. The progeny all bore violet flowers but almost half of them were short. This suggests that genetic make up of the tall present can be depicted as (a) TTWW (b) TTww (c) TtWW (d) TtWw.

Ans. (c) TtWW.

Q#19 An example of homologous organ is

a) Our arm and a dog's for leg
b) Our teeth and elephant tusks
c) Potato and runners of grass
d) All the above

Ans. (d) All the above.

Q#20 In evolutionary terms we have more in common with

a) A Chinese school boy
b) A chimpanzee
c) A spider
d) A bacterium.

Ans. (a) A Chinese school boy.

Q#21 A study found that children with light coloured eyes are likely to have parents with light coloured eyes. On this basis can we say anything about whether the light eye colour is dominant or recessive? Why or why not?

Ans. No. We cannot say with certainty whether the light eye colour is dominant or recessive. But since both the parents as well as the children have light eye colour, the probability is that it is a recessive trait. A recessive trait appears only when an individual possess both the recessive alleles. As the parents are pure for the trait, the children also possess the trait and are pure for the same. Had the light eye colour been a dominant trait, the recessive dark colour trait will have the chance to segregate and appear in some of the children.

Q#22 How are the areas of study, evolution and classification interlinked?

Ans. Classification is based on similarities and differences amongst organisms. The more characteristics two species have in common, the more closely related they are. They must have evolved from a common ancestor. Similarly more differences mean different adaptations and divergence from common ancestor in the remote past.

Q#23 Explain the terms analogous and homologous organs with examples.

Ans. Analogous Organs:-They are organs which have similar appearance and function but are quite different in their origin, development and anatomy.

Examples: - Wings of Butterfly (integumentary outgrowths) and bird (modified fore-limbs).

Homologous Organs:- They are organs which have similar origin, similar development and similar internal structure but have different forms and functions.

Example:- Fore-limbs of Horse, human hand, flipper of whale, wing of bird or bat.

Q#24 Outline a project which aims to find the dominant coat colour in dogs.

Ans.
1. Survey the dog population in and around your locality. Find out the percentage of different colours.
2. Observe the lineages where same colour is present in both parents and offspring. There is possibility that in these lineages both the alleles of coat colour are similar.
3. Allow crossing between two lineages.
4. Find the colour F1 individuals. It is probably the dominant coat colour.
5. Cross the F1 dogs with the one having the other probably recessive colour. Is the ratio similar to test cross, i.e., 1 : 1 ?

Q#25 Explain the importance of fossils in deciding evolutionary relationships.

Ans. Fossils are remains or impressions of past organisms that are found in the rocks. Fossils of lower strata belong to early periods while those of upper strata are of later periods. Arranging the fossils stratum wise will indicate the occurrence of different forms of life at different times. It is found that the early fossils generally belong to simple organisms. Complexity and elaboration increased gradually with evolution. Evolution has never been linear or straight. A number of variants or branches appeared, some of which were more complex while others were less complex.

1. Fossils indicate the path of evolution of different groups.
2. They can indicate the phylogeny of some organisms, e.g., Horse, Elephants.
3. Some fossils have characteristics intermediate between two groups , e.g., toothed bird Archaeopteryx. They indicate how one group has evolved from another.

Q#26 What evidence do we have for the origin of life from inanimate matter?

Ans. Miller and Stanley (1953) assembled an apparatus which had a spark chamber (for producing lightning), a flask for boiling and a condenser. They introduced a mixture of methane, ammonia, hydrogen and water into the apparatus. The gaseous mixture was exposed to electric discharges, condensation and boiling with the temperature kept just below 1000C. The experiment was continued for a few days. At the end of one week, 15% of carbon (from methane) had been converted into simple organic compounds of amino acids, organic acids, sugars and nitrogen bases. It clearly proved that organic compounds or building blocks of life developed from inanimate matter in the remote past when the hot earth was cooling.

Q#27 Explain how sexual reproduction gives rise to more viable variations than asexual reproduction. How does this affect the evolution of those organisms that reproduce sexually?

Ans. Variations arising during sexual reproduction occur due to (i) Chance separation of homologous chromosomes during gametogenesis. (ii) Crossing over between homologous chromosomes. (iii) Chance coming together of chromosomes during fertilization. (iv) Errors or mutations occurring during DNA replication. Only the last method of variations is found in asexually reproducing organisms. The rate of appearance of variations is quite high in sexually reproducing organisms as compared to asexually reproducing organisms. Therefore, the rate of evolution is also high in sexually reproducing organisms. Their variations are quite viable because most of them are due to reshuffling of genetic material.

Changes in DNA that occur during replication are fewer. Most of them are harmful. They have a negative impact on evolution except when the changing environment finds them useful.

Q#28 How is equal genetic contribution of male and female parents ensured in the progeny?

Ans. Most organisms are diploid. Their genetic material consists of two sets of chromosomes. Gametes carry single set of chromosomes, i.e., they are haploid. Sexual reproduction involves the formation and fusion of two types of gametes, male and female. Male gamete brings one set of chromosomes from the male parent. Female gamete also brings one set chromosomes from the female parent. When two gametes fuse during sexual reproduction, the normal diploid chromosome complement is restored. It consists of 50% chromosomes from male parent and 50% chromosomes from female parent. Therefore, both the parents contribute equal genetic material to the offspring through formation and fusion of gametes.

Q#29 Only variations that confer an advantage to an individual will survive in a population. Do you agree with this statement? Why or why not?

Ans. No. Along with advantageous variations, a number of indifferent variations remain in the populations. Only the disadvantageous variations which are either lethal or extremely harmful are eliminated. All other variations persist in the population. Many of them function as preadaptations.

Reproduction

Q#1 Define Reproduction.

Ans. The ability to reproduce that is to produce a new generation of the individuals of the same species. It is one of the fundamental characteristics of living organisms. It involves the transmission of genetic material from the parental generation to the next there by ensuring the characteristics not only the species but also of the parental organisms are perpetuated. The significance of reproduction in a given species is to replace that member of the species that die thus ensuring the continuity of the species. The purpose of reproduction is aimed at increasing population and perpetuation of the species. In other words it provides group immortality by replacing the old with the new ones. It also leads to an increase in the number of species where conditions are suitable.

Feature of Reproduction: - All organisms reproduce by modes of reproduction which vary in different organisms, how ever all modes have certain common basic feature these are:

a) Replication of D.N.A this is the molecular basis of reproduction.
b) Cell division, only mitosis or meiosis.
c) Formation of reproductive bodies or units.
d) Development of reproductive in a variety of ways.

Q#2 Differentiate between sexual and asexual reproduction.

Sexual Reproduction	Asexual Reproduction
1. It is generally biparental.	1. It is usually uniparental.
2. It involves the sex cells or gametes.	2. It does not involve sex cells or gametes.
3. Fertilization generally occurs.	3. Fertilization does not occur.
4. It involves mitosis and meiosis.	4. It involves only mitotic division.
5. It contributes to evolution by introducing variation in offspring.	5. It contributes little to evolution.
6. It causes slower increase in number.	6. It often causes rapid increase in number.
7. It occurs nearly in all animals.	7. It occurs in only in lower invertebrates.

Q#3 What is the importance of D.N.A copying in reproduction?

Ans. D.N.A copying is an important phenomenon of reproduction through which the organisms pass on their body features of their offspring's. It maintains the body design features in different generation of the species. DNA copying also produces variation due to linkage and crossing over. Such variations are useful for the survival of species overtime.

Q#4 Define variation and its significance.

Ans. The differences in characteristics seen among individuals of a species are called variations. The similarities and dissimilarities among the members of a species are not coincidental.

Significance are:-

1) Variation helps man in improving the races of useful plants and animals.
2) It enables the organisms to adapt themselves to changing environment.
3) Variation enables the organisms to face the struggle for existence in better way.
4) Variation produces new traits in organisms in a single generation.
5) Without variation other species will not change into new species and there will be no evolution.

Q#5 What are the different types of asexual reproduction?

Ans: Different types of asexual reproduction are:-

a. **Fission: -** This is the most common method of asexual reproduction in unicellular organisms like blue green algae and protozoans (amoeba, Euglena and paramecium) when the individual cell is fully mature, it divides into two, this is called fission. Depending upon the number of individuals formed from a single parent, the fission can be of two types:-

1. **Binary fission: -** When two almost equal sized daughter cells are produced from a single parent, it is called binary fission. The daughter cells so formed grow fully and divide again (amoeba).

2. **Multiple fission: -** Sometimes, during unfavourable conditions, a cyst or a protective coat or wall is formed round the cell (e.g., plasmodium). The nucleus of the cell divides many times followed by the cytoplasm within the cyst to produce many daughter cells. The cyst is then broken releasing many cells at once. When several new individuals are formed from a single parent, it is called multiple fission.

b. **Budding: -** In this method of asexual reproduction, a small out growth, called the bud appears on the body wall (micro organisms) or on any part of the body (multi-cellular organisms like hydra and yeast) of an organism. The nucleus of the parent cell undergoes division to form two daughter nuclei. One of the nuclei then passes into the bud. The bud grows gradually and then breaks off from the parent and becomes a new individual. Under favourable conditions, this process is repeated.

c. **Fragmentation:-** Sponges, flat worms etc. carry asexual reproduction through fragmentation. In this method body of an organism divides into two or more fragments either naturally or by some external agency. Each fragment then gradually develops into a complete adult.

d. **Sporulation or Spore formation: - The** mode of asexual reproduction is observed in plants which do not form seeds. Such plants produce spores which are light in weight and very small in size. They are provided with thick walls which enable them to withstand unfavourable environmental conditions. These spores develop into new individuals, when they fall on a favourable substratum under favourable conditions. It is very common in some fungi (mucor) bacteria and algae.

Q#6 What is vegetative propagation? What are the different methods of Vegetative Propagation?

Ans: -Vegetative propagation: - It is the production of new plants from some vegetative part of a plant. In this method of asexual reproduction, vegetative part/parts like leaf, stem, root of the plant are (or get) detached from the plant in the growing period. These parts when planted in soil develop into new and complete plants under suitable conditions. The daughter plants produced resemble their parents in all respects. Vegetative propagation occurs by natural as well as by artificial methods and is very common in seedless plants.

Methods of vegetative propagation:-

1. **<u>Grafting:-</u>** It involves the joining together of plants of two different plants (appear, pears, mangoes) in such a way that they can live as one plant. One of the two plants is rooted in the soil and is called the stock. The other part (or bud) detached from a matured tree of the desired variety is inserted into the stem or root system of the stock and is known as scion. The place where they are grafted is covered with grafting wax to avoid infection. The roots of the stock give water and minerals to the scion and the leaves of the scion supply organic food to the root system of stock. The grafted plant bears flowers and fruits identical to the fruits of the tree from which the scion was taken. Grafting is successful only if it is practiced between closely related plants.
2. **<u>Cutting:-</u>** In this method, a piece of suitable length of stem (6-10cm long) bearing a few nodes and internodes is taken from the mother plant. This cutting is then placed slightly vertically in moist soil. After sometime, roots emerge from nodes of the basal portion of the cutting and the buds found on the cutting give rise to the shoot resulting in the formation of a new plant. The plants of rose, sugarcane, pine apple, banana, orange etc. are commonly grown by this method.

3 **Layering:-** This method is commonly practiced in ornamental plants such a jasmine, rose etc. In this method one or more shoots of a plant are bent close to the ground and covered with moist soil. Sooner or later, the underground portion of the branches (layer) develops roots and produces plantlets. These plant-lets are cut off from the parent plant when they became new individuals. Layering, however, is a natural means of reproduction in black raw berries or trailing black berries (small wild black fruit).

4 **Vegetative Propagation by leaf or adventitious buds**:- The fleshy or succulent leaves of Bryophyllum bear adventitious buds in their notches located on the margins. When the leaf falls on a moist soil, these buds develop into small plants resulting in vegetative propagation.

Q#7 What is tissue culture in plants?

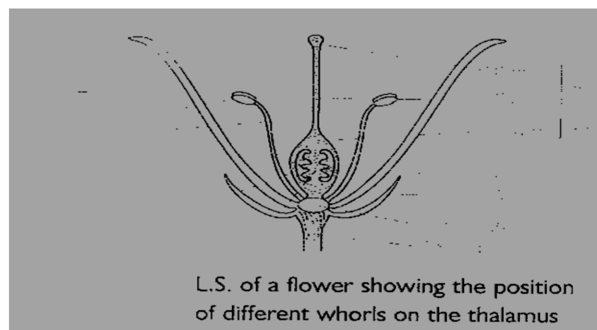
Ans: - It is a new technique of vegetative propagation used in plants. In this technique a small vegetative tissue of the plant is separated and put in a container containing nutritive material. The cells of vegetative tissue divide mitotically repeatedly forming a mass of similar cells and is called callus.

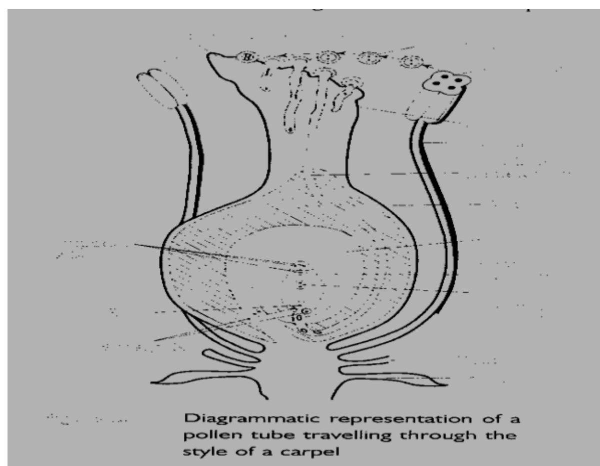
Small pieces of the callus can be detached and put in another medium separately where differentiation of cells takes place to form a small platelet. The later is taken and it develops into a complete plant.

Sexual Reproduction: - This form of reproduction involves two sexes-male and female which produce specialized cells called gametes. The male gametes are called sperms where as female gametes are called ova (eggs). The ovum is often filled with preserved food. Generally sperms are more active than ova, but they remain passive. Such individual who produce only one gamete may be unisexual male or unisexual female e.g. man, cat, dog, etc. some organisms can produce both male and female gametes. These are called bisexual or hermaphrodite. The bisexual individuals produce either male gametes or female gametes at a given time example; Hydra, Earthworm, etc.
The fusion of male and female gametes is known as fertilization and the product formed is called zygote, which develops to form a new individual. Gamete formation takes place after meiotic division. The number of chromosomes is maintained.

Sexual Reproduction in Plants: - The flower is a reproductive part of a plant which develops from floral bud. The flower may be unisexual or bisexual. Flowers generally bear a long or short axis, which has two parts- Stalk and Thalamus- containing four sets of floral parts arranged symmetrically. These are sepals (calyx), petals (corolla), stamens (androecium = male) and carpel. Androecium is composed of many stamens, which are the male reproductive parts. Each stamen consists of two anthers at the tips, which carry pollen grains. Pollen grains are microscopic structures, each of which produces two sperm cells. Gynoecium consists of many carpels or pistils which are the female reproductive parts of the flower. The pistil is broader at the base and taper at the top. The lower broader portion is called the ovary that contains ovules. The ovules contain eggs. The upper portion of the pistil is called the style, which has on its tip sticky disk like structure called the stigma.
Pollination is the process of transference of pollen grains from the anthers of a flower to the stigma of the same or another flower of the same species. Self-pollination or Autogamy involves the transference of pollen grains from the anther to the stigma of the same flower while cross-pollination or allogamy involves the transference of pollen grains from the anthers of the flower to the stigma of the another flowers of the same species. It takes place by the various agencies such as wind, water, insects, birds, animals and man. After pollination the pollen grains give rise to the pollen tube containing the two male gametes. One male gamete passes through the pollen tube and reaches the egg in ovule. It fuses with the egg and the zygote is formed. The fusion is called fertilization. The zygote divides mitiotically.
After fertilization (i.e. post fertilization), the sepals, petals, stamens, style and stigma fall off. The zygote forms the seed and ovary becomes the fruit. The seed contains a potential plant or embryo. The embryo contains tiny root (Radicle), a small shoot (plumule) and seed leaves (cotyledons) that contains preserved food. The seed coat protects the seed until germination. Germination is a process

by which the dominant embryo resumes growth and grows out of the seed-coat to establish itself as a seedling.


L.S. of a flower showing the position of different whorls on the thalamus


Diagrammatic representation of a pollen tube travelling through the style of a carpel

Q#5 Define the following terms: Gametes, Zygote, Unisexual individuals, bisexual (hermaphrodite) individuals, fertilization, External fertilization, Inter fertilization, Pollination, Self pollination and Cross pollination.

Ans.
1. **Gametes:** The specialized haploid cells involved in fusion during sexual reproduction are called gametes or sex-cells.
2. **Zygote:** The diploid structure formed as a result of fusion of male and female gametes is called zygote.
3. **Unisexual Individual (Mono-sexual or Dieocious):** The individual which bears only one sex organ (either male sex organ or female sex organ) is called unisexual individual e.g., man, frog.

1. **Bisexual Individual (Monoecious or hermaphrodite):** The organism bearing both male and female sex organs or the organism which is capable of producing both male as well as female gametes is called bisexual individual e.g., hydra, earthworm etc.
2. **Pollination:** The process of the transfer of pollen grains from the anthers to the stigma is called pollination. If the pollen is transferred to the stigma of the same flower (pea, china rose) it is termed as self-pollination or autogamy. If the pollen is transferred from the anthers of one flower to the stigma of another flower of the same species, it is called cross-pollination or allogamy.

Q#6 Describe the sexual reproduction in animals.

Ans: In animals sexual reproduction is found in unicellular as well as in multi-cellular organisms and is performed by various methods. In unicellular organisms such as, the monocysts (protozoan) two cells which take part in sexual reproduction are morphologically similar (Isogametes). While in plasmodium (malaria parasite) they are dissimilar in appearance.

In multi-cellular animals (man), the male produces small, motile and active gametes called sperm and the female produces a non-motile, large and inactive gamete called ovum. The fusion of male gamete with female gamete is called fertilization. In some multi-cellular organisms, fertilization is external while in some others, internal fertilization takes place. As a result of fertilization, a diploid cell called zygote is formed. The latter finally gives rise to a new individual.

Q#7 Define the following terms: Puberty, Menstruation, Menarche, Menopause, Ovulation, *Graffian* Follicle, Corpus luteum and Parturition.

Ans <u>**1. Puberty**</u>: Puberty is that phase of life in which reproductive organs mature and the secondary sex-characteristics make their appearance. The sexual maturity (puberty) is attained anywhere from 12 – 17 years of age in humans. The stage of puberty ends with first menstruation cycle in females and with spermatogenesis in males. The end of the puberty is followed by the beginning of the adolescence.

2. Menstruation: It is a process in which the blood mucus and uterine tissue are eliminated in female mammals. Menstruation begins at puberty (12-13 years) and lasts up-to 45-50 years of age, when reproductive capacity is arrested.

3. Menarche: The first menstruation in the life of a girl is called menarche.

4. Menopause: The period after the age of 45-59 when ovulation and menstruation is stopped in females is called menopause.

5. Ovulation: The release of an ovum (or egg) from an ovary is called ovulation.

6. Parturition: It is a process of expulsion of *foetus* from the uterus through vagina. It starts at the end of pregnancy.

7. Graffian Follicle: These are the fluid filled spherical cavities in which the eggs develop in the ovaries of the mammals.

8. Corpus luteum: An endocrine organ formed by the enlargement of the *graffian* follicle after the release of an ovum in mammals. In the normal course of events these bodies develop for a short time and then die down. If pregnancy occurs, however, they continue to grow and release the hormone progesterone which brings about the enlargement of the uterus and other changes.

Q#8 Write a short note on pregnancy.

Ans: If the ovum in the fallopian tube meets the sperm cell and fertilization takes place, the corpus *luteum* persists and the menstruation stops, the female is said to be pregnant. The duration of pregnancy is about 280 days or 40 weeks from the first menstruation cycle. In a pregnant woman menstruation cycle is stopped temporarily till the birth of the child. During pregnancy embryo remains attached with the *utrine* wall through a connection called placenta. There occur certain changes in the mother's body during pregnancy. Some of the changes are: (i) The uterus increases in size (ii) The quantity of blood flowing to the uterus increases (iii) The *foetus* and placenta in the uterus grow in size

(iv) Dark lines appear on the mother's abdomen. (v) The weight of expectant mother increases.

(vi) Composition of mother's body fluid changes.

Q#9 Describe the female reproductive system in humans.

Ans: The female reproductive system in humans consists of the following organs:-

i. A pair of ovaries ii. Fallopian tubes iii. Uterus iv. Vagina

i. Ovaries:- (shape –flattened, rough almond –shaped; Weight = ≅ 4 – 8 grams each; Length = 2.5 – 5 cm; Width = 1.5 – 3 cm; Thickness = 0.5 – 1.5 cm)

The primary sex organs of a female are a pair of ovaries. They are located in the pelvic region on either side of the uterus. The ovary is invested in a continuous layer of germinal epithelium. Beneath this layer is a dense connective tissue layer, the *tunica albuginea*. Embedded in the connective tissue *stroma* of the cortex are *follicles* that contain the female sex cells, the ova.

At birth , each ovary has 250,000 – 500,000 ova, out of which only 400 ova are matured and are released in a normal human life spine, the rest of the ova degenerate during the lifetime.

Function:- The ovaries have two functions:-

1. To secrete female sex hormones and (Poesterogen)
2. To form the female gametes, ova

ii. Fallopian tubes (oviducts):- The fallopian tubes are two narrow muscular tubes measuring about 12cm long. These are attached to uterus at one end. Their other end is funnel shaped and bears finger like projection, known as *fimbriae*. This end is close to the ovary.

Function:- (i) When the ovum is released by ovary (ovulation), it is picked up by the *fimbriae* and pushed ahead into the fallopian tube. The fallopian tube conducts the ovum to the uterus by means of muscular & *ciliary* action. (ii) Fertilization takes place in fallopian tube.

iii Uterus :- (Shape-pear shaped ; Length =7-7.5cm; Width = 4-5 cm; Thickness = 2.5-3.5cm – in non-pregnant state)

The human uterus (womb) is a hollow, highly muscular, thick walled organ. It is connected on either sides with fallopian tubes. Its upper part called body or *fundus* is broad while its lower part, called

neck or *cervix* is narrow. The body of the uterus comprises three coats; the innermost *endometrium*, middle *myometrium* and outer most *perimetrium*.

Functions:- (i) In the uterus, embryo develops. (ii) Menstruation, pregnancy and labour are performed by its different layers. (iii) Cervix (mainly a sphincter muscle) closes the uterine lumen and prevents the entry of foreign particles into the uterus.

iv. Vagina: This short (about 2 cm wide and 7 cm or 9 cm long) thin walled, muscular tube extends from the lower margin of the uterus to the exterior of the body.

Functions: - (I) functionally, it receives the penis (sperms) during coitus or copulation. (ii) It transports un-fertilized ova and *menstrual* products to the exterior. (iii) It is through vagina that the child enters into the world.

(The distal end of the vagina is blocked partially by an incomplete, transverse, membranous partition called, hymen in the virgin which generally is ruptured during the first sexual inter course.)

Secondary sexual characters in human females:-

1. Growth of breasts and external genitalia (vulva).
2. Growth of public hair and extra hair in armpits.
3. Hair on beard, moustache and chest are lacking.
4. Broadening of pelvis.
5. Initiation of menstruation and ovulation.
6. Increase in the subcutaneous fat, particularly in the thighs, shoulders and face.

Q#10 Describe male reproductive system in human beings.

Ans: The male reproductive system in humans consists of the following organs:-

i. A pair of testes ii. *Epididymis* *iii. Vas deferens* iv. Seminal vesicles
v. Prostate glands vi. Cowper's gland vii. Urethra

1. Testes: (Shape –oval; L = ≅ 4 – 5 cm, W= 2.5cm, T=3cm, Wt.=100gm each). The primary sex organs of a male are a pair of testes. They are suspended in thin pouches of skin and connective tissue

called scrotum located outside the main body cavity behind the penis. Internally the testes contain a mass of coiled tube, the *seminiferous* tubules which are bound together by connective tissue. Internally these *tubles* are lined by germinal epithelium. The cells of which divide *meiotically* to form male gametes or sperms (spermatogenesis). In the interstitial spaces between the *seminiferous* tubules are *present* interstitial cells also called *leydig cells.*

Functions:- i. To produce sperms ii. to produce male sex hormones called androgens (testosterone and *endrosterone)*

2. *Epididymis*:- About 800 *seminiferous* tubules join together to form a long (6 metre), tightly coiled and very thin coiled tube, the *epididymis*. The *epididymis* lies along side the testis in the scrotal sac.

Functions:- It functions as main store house for sperms (stores sperms for 18 hours to a few days). In it, the sperms become mature, motile and acquire more fertilizing power.

3. Vas *deferens*:- From the *epididymis*, the sperms move into the vas *deferens*, which is a straight tubular structure having a muscular wall which has non-ciliated epithelium on the inner side. Vas *deferens* connects the duct from seminal vesicles to form an ejaculatory duct.

Functions:- The muscular action of the wall of the *vas-deferens* is mainly responsible for the further movement of sperms.

4. Seminal vesicles:- These are a pair of thin walled, muscular and highly coiled short tubes located at the base of the urinary bladder above the prostate gland.

Function:- Seminal vesicles secrete a viscous fluid which keeps the sperms alive and active.

5. Prostate gland:- There are paired, *lobulated* glands which secrete a thin alkaline fluid, the *prostatic* fluid. The *prostatic* fluid together with the secretion of the seminal vesicles passes into the lumen of the urethra.

Function:- *Prostatic* fluid secreted by the prostate glands imparts a characteristic smell to semen.

6. *Cowper's* gland or *Bulbo-urethral* glands:- These paired glands occur below the prostate glands

and join the urethra a short distance later.

Function:- They secrete a white, viscous, *mucoid*, alkaline substance which acts as a lubricant.

7. Urethra: - It is a muscular tube which starts from the urinary bladder and passes through the penis to the tip of the glands penis.

Function: - It helps in passing out urine as well as semen.

Secondary sexual characters in human males:-

1. Enlargement of penis and scrotum.
2. Broadening of the shoulders and increased muscles development.
3. Enlargement of larynx and thickening of vocal cords producing deeping of the voice.
4. Growth of public hair and extra hair on the face, in the armpits and on the chest.
5. Changes in the behaviour associated with courtship and mating.

Q#11 What is menstruation cycle?

Ans: - A series of changes take place in the female sex organs within a period of 28 days or so. These changes constitute a menstrual cycle. The menstrual cycle involves maturation of follicle, discharge of ovum from the ovary and release of unfertilized ovum or egg with uterine debris.

Q#12 Describe menstrual cycle in different stages.

Ans: - Menstrual cycle in different stages is described below:-

Stage 1. Menstrual or Menstrual flow:- It lasts for 3 to 5 days. During this stage, the uterine lining the endometrium degenerates causing bleeding. The sloughed off endometrium, the blood and the unfertilized ovum then passes out as menstrual flow.

Stage 2. Post menstrual stage or poliferative phase:- After menstrual flow, the endometrium reappear and the uterus regains its normal structure and size. The follicle grows and matures in the ovary. This stage continues for about 5-13 days.

Stage 3. Ovulation:- Ovulation takes place on about the fourteenth day of the cycle, the follicle bursts releasing ovum. The ovum is picked up by the fimbriae of fallopian tube.

Stage 4. Premenstrual or Progestational stage:- At this stage the corpus luteum develops from the ruptured follicle and persists over the next 12 to 14 days. The ovum moves to the uterus by ciliary & muscular action in the fallopian tube, if the ovum is fertilized, corpus luteum grow & secretes the hormones mainly. Progesteron prevents ovulation, if the ovum is not fertilized corpus luteum degenerates towards the end of the menstrual cycle.

The menstrual cycle ends in pregnancy or restarts after the removal of the endometrial lining in another menstrual flow.

Q#13 What is the difference between male & female urethras?

Ans: - In males' urethra there is a single opening for the elimination of urine and for the ejaculation of sperms. But in female urethra, there are two separate openings, one for the elimination of urine and one for the ejaculation of reproductive products.

Q#14 What are the various methods to control fertilization/ birth control?

Ans. The methods or devices of birth control which deliberately prevent fertilization are referred to as contraception.

1. Barier methods.
2. Chemical methods
3. Intrauterine contraception device (IUCD)
4. Surgical methods

These methods are as follows:-

1. Barrier method:

a) **Condoms:-** These are thin, strong rubber sheaths used by man to cover the erect penis. It is simple but effective and widely used contraceptive that has no side effect.

b) **Femidon:-** It is not a common contraceptive method. A femidon is a thin rubber or polyurethane tube which fits inside vagina. It is used by female just before starting coital activities.

c) **Diaphragm**:- It is flexible rubber/ plastic cover that it is fitted over the cervix in the female's vagina I checks the entry of sperms into the uterus.

Chemical methods:- These chemicals adhere to the mucous membrane and immobilizes and kill the sperm:

a) Oral pills are also used to check ovulation. These are mainly hormonal preparations and contain estrogen and progesterone. These prevent development of egg and ovulation by inhibiting secretion
of FSH. The oral pills act on hypothalamus, pituitary and the ovaries. They are called oral contraceptives (OCS).

b) Vaginal pills are drugs preparations which contains spermicidal. They are used before copulation by women.

Intrauterine contraceptive device (IUCD):- These are contraceptive devices made of copper plastic or stainless steel. A copper – T is inserted into uterus by a practicing doctor or a skilled nurse and left in place. It prevents implantation in the uterus.

Natural method:- These method includes abstinence, rhythm method (ovoid copulation around the time of ovulation) and coitus interrupts (with drawal of penis before ejaculation)

Surgical method:- Surgical method are safe in the long run but they may cause infection and other problems if not done properly. These methods include:

a) **Vasectomy: -** This a small surgical operation performed in males. It involves removal of a small portion of the sperm duct (or vas deferens) by surgical operation. The two cut ends are then ligated (tied) with threads. This prevent the sperms from coming out.

b) **Tubectomy:-** This is a surgical operation performed in females. It involves removal of a small portion of the fallopian tubes by surgical operation. The cuts are then ligated with threads. It prevents the egg (ovum) to enter the fallopian tube.

Q#15 Define Menarche and Menopause.

Ans. At puberty, the commencement of menstruation is termed menach. It marks the beginning of the reproductive life of human female. The reproductive cycle continue to occur till the age of 50 (45 to 55
in Indian women). After this age, the menstruation stops. Cessation of cycle of events in ovary and uterus around the age of 50 years and stoppage of menstrual flow is termed menopause.

Q#16 Define puberty and secondary sexual character in males and females.

Ans. Puberty is the age of human males and females at which the reproductive organs become functional, gonads starts producing gametes and sex hormones, and the boys and the girls become sexually mature.

Menstruation:- It is the periodic discharge from the uterus. When a girl is 13-15 years old, she begins to ovulate. The menstrual cycle normally occurs regularly every 28^{th} days. The process continues for 3-4 days. The blood coming out along with tissues, is called menses, but is prevented during pregnancy. The ovulation takes 10-12 days after the start of menstruation. In male, puberty is trigged by the secretion of the hormone- testosterone from the tests. In females, puberty is trigged by the production of hormone- estrogen from the ovaries.

Q#17 Define placenta and its functions.

Ans. Placenta is a temporary organ formed in the eutherian (placental) mammals only and is the only organ in animals formed of the tissues derived from two different individuals the foetus and maternal blood close enough to permit the exchange of materials between the two.

A large number of branching villi from the vascular chorion penetrate the corresponding pits the crypts, formed in the uterine wall. The later becomes very thick and highly vascular to receive the villi. The placenta has two parts the parts contributed by the foetus i.e. chorionic villi, is called the foetalplacenta; and the part shared by the mother i.e. part of uterine wall is termed the maternal placenta.

Functions of placenta:-

1. **Nutritive organ**:- food material passes from the mother's blood into the foetal blood through the placenta.
2. **Digestive organ:-** The trophoblast of the placenta digest (break down) proteins before passing them into the foetal blood.

3. **Respiratory organ:-** Oxygen diffuses from the maternal blood into the foetal blood through the placenta. Carbon dioxide diffuses from the foetal blood into the maternal blood also through the placenta for elimination by the mother's lungs.
4. **Excretory organ:-** Nitrogenous wastes, such as urea pass from the foetal blood into the maternal blood via placenta for elimination by mothers kidney.
5. **Endocrine organ:-** Placenta secretes human chronic gonadotrophin (HCG) oestrogens, progesterone and human placental lactogen.
6. **Storage organ:-** The placenta stores glycogen for the foetus before liver is formed.
7. **Barrier**:- Placenta was earlier thought to disallow the passage of necessary materials from the maternal blood into the foetal blood.

Q#18 Define parthenogenesis.

Ans. Simply the method of developing an organism may be haploid if produced from haploid egg or diploid if produced from diploid egg. Or the process of producing organisms without fertilization.

In plants, some plants are able to produce fruits without fertilization such fruits are called partheno carpic fruits. They are seedless or contain empty or non valuable seeds e.g. Banana, pine apple, grapes, cherry, peaches, etc.

Q#19 Define post fertilization changes.

Ans. Immediately after conception i.e. fusion of male and female gametes to form a zygote, the embryonic development begins in the fallopian tube, the stage marks the beginning of pregnancy. As the zygote moves from the fallopian tube down towards the uterus, it starts dividing by successive nuclear and cell division resulting in the formation of a small multicultural ball of cells by the process called cleavage. The young multicellular embryo, formed as a result of cleavage, is now called Blastocyst. The blastocyt gets embedded into the thickened inner wall of uterus. The close attachment of the blast cyst to the uterine wall is called Implantation. It takes place about seven days after fertilization. Implantation is followed by a number of development changes in the blastula. A special umbilical cord develops in the fourth week which establishes an intimate connection between the foetal membrane and the uterine wall, called Placenta. Here the exchange of materials between the mother's blood and the blood of foetus gets nutrients, water, oxygen, minerals, vitamins, etc. from the maternal blood and gives of wastes carbon dioxide, urea and etc. Thus the placenta serves as the nutritive, respiratory and excretory organs of the foetus.

The complete development of foetus from the initial stages of conception till the birth of the young one is called gestation it is also termed pregnancy. Gestation is completed in about 280 days or 40 weeks. Gestation is followed by parturition. Parturition is the act of expelling the full term young one from the mothers uterus at the end of gestation.

Q#20 Define Triple fusion.

Ans. Fusion of male gamete with two female polar nuclei inside embryo sac is called triple fusion.

Q#21 What is the average duration of human pregnancy?

Ans. 280 days or 40 weeks.

Q#22 What is syngamy?

Ans. Fusion of male and female gametes is called syngamy.

Q#23 Why is variation beneficial to the species but not necessary for the individual?

Ans. Population of organisms normally live and interact with definite kinds of ecological niches. A population therefore, survives in a particular ecological surrounding. If there is an alteration in the ecological conditions of such places, the population of organisms will get damaged and may be wiped out. The variants of the organisms however may have chances of survival. The surviving individuals may reproduce and develop a kind of population which is suited to the changes much thus variation is beneficial to the species but not necessary for the individual.

Q#24 Explain fertilization. Give its types.

Ans. It can be defined as the fusion of male gamete with a female gamete to form zygote. In human being fertilization is internal, fertilization is irreversible and usually species sperm fertilize an egg if one is present with in 30 minutes after ejaculation, the various significance of fertilization are:-

1. It provides stimulus for the egg to complete its maturation.
2. It makes the egg more active metabolically.
3. It determines the sex of young one.
4. It restores the diploid number.
5. It combines the character of parents.

Internal fertilization: - If fertilization takes place inside the body of an organism such fertilization in termed as internal fertilization. In human being fertilization takes place inside the fallopian tube of female.

External fertilization: - If the fertilization takes place outside the body of an organism such fertilization is termed as external fertilization e.g. frog.

Textual Questions

Q#1 What is the importance of DNA copying in reproduction?

Ans. DNA copying is the basic event of reproduction because DNA contains information for inheritance of characters or traits from parents to the next generation. DNA present in the cells undergoing reproduction produces its copy so that the information for the development of characters may pass over to the next generation through dividing cells or gametes.

Q#2 Why is variation beneficial to the species but not necessary for the individual?

Ans. A species comprises a large number of individuals. Each individual may have specific type of variations of different nature. Individually these variations may not be of much benefit to a particular organism but when specie faces a drastically altered condition, some of its members may survive because of possessing such variations which are capable to face the new situation. In this way, variations save the species from becoming extinct and promotes its survival for a long time.

Q#3 Why is DNA copying an essential part of the process of reproduction?

Ans. DNA copying is an essential part of reproduction because DNA contains all the information to be passed over to the next generation for the development of characters. During reproduction new calls are formed, each one of them must receive a copy of DNA so that specific characters may develop in the newly formed individuals.

Q#4 How does binary fission differ multiple fission?

Ans.

Binary fission	Multiple fission
1. It occurs during favourable conditions.	1. It occurs when an organism faces unfavourable environmental conditions.
2. A single organism splits to form two identical organisms.	2. During this process many new organisms are formed from a single one.
3. Nucleus divides only once during this form of reproduction.	3. Nucleus divides repeatedly to form large number of nuclei.
4. Protective covering is not formed around organism.	4. Protective covering or cyst is formed around the organism during multiple fission.

Q#5 How will an organism benefit if it reproduces through spores?

Ans. (a) It is a simpler and faster mode of reproduction.

b) Spores being small and light get easily dispersed through wind, water and animals. Thus, dispersal of organism becomes easier.

c) Spores bear thick resistant covering to enable them to survive even in unfavourable conditions.

Q#6 Can you think of reasons why more complex organisms cannot give rise to new individuals through regeneration?

Ans. Certain specialized cells found in simple organisms have the potential of giving rise to new individuals, when they get detached from the parent body. This process is called regeneration. Complex organisms lack such specialized cells, so when a mass of cells in complex form gets detached it fails to grow in a new individual.

Q#7 Why is vegetative propagation practiced for growing certain types of plants?

Ans. a) To preserve characters of the plants through successive generations.
b) Seedless plants can be grown through vegetative reproduction.
c) Through cutting and grafting methods flowers and fruits can be grown in a shorter time.
d) It is a cheaper, easier and more rapid method of plant propagation.

Q#8 How is the process of pollination differ from fertilization?

Ans. Pollination is the process of transfer of pollen grains from the anther of a flower to the stigma of the same flower or another, whereas fertilization is a post pollination phase during which fusion of male and female gametes occurs to form zygote.

Q#9 How are the modes of reproduction different in unicellular and multi cellular organisms?

Ans. In unicellular organisms asexual mode of reproduction like fission, fragmentation and sporulation are the main source of producing new organisms, however some forms exhibit primitive type of sexual reproduction like conjugation in Paramecium and formation of isogametes in Polystomella.

In multicellular organism the primary source of reproduction is through sexual means, although in relatively simpler multi cellular forms reproduction occurs by budding, regeneration, spore formation and vegetative propagation.

Q#10 What is the role of the seminal vesicles and the prostate gland?

Ans. The seminal vesicles in males store sperms produce viscous fluid which provides energy to the sperms and stimulates uterine contraction to help sperms move forward into female tract. Prostate gland secretes milky fluid which helps in sperm mobility.

Q#11 What are the functions performed by the testes in human beings?

Ans. Testes are the primary sexual organs of males, which perform the following functions.

- Sperms are formed inside the seminiferous tubules of testes.
- Leydig cells (interstitial cells) of testes produce male sex hormone- testosterone. Testosterone controls the normal growth of genital organs and helps in the development of secondary sexual characters of males.

Q#12 Why does menstruation occur?

Ans. The endometrium of uterus of a female becomes ready to receive foetus at every twenty eight day's interval. If fertilization does not occur and embryo is not formed, endometrium breaks down and bleeding occurs. This process is called menstruation. So, menstruation occurs as a consequence of non-fertilization of egg.

Q#13 What are the advantages of sexual reproduction over asexual reproduction?

Ans. During the process of sexual reproduction gametes are formed which involve DNA copying mechanism, crossing over and fusion of gametes from biparental sources. Error in DNA copying mechanism and crossing over produce different forms of variations in different individuals. Then the gametes of two individuals with different types of variations combine, they create a new combination of variants. Such variations not only enhance the survival chances for a species but also play an important role in evolution.

During asexual reproduction variations are not produced or even if they appear they are very slow, mainly through mutation, thus are of no use in evolution and survival of species.

Reproductive health and sexually transmitted diseases

The reproductive life of human begins, at puberty and continues through out life in males and upto menopause in females. Like physical fitness, mental, social fitness, human beings need fitness of reproductive life. This is called reproductive health. It includes such aspects that ensure a

responsible, safe and satisfying reproductive life. It is our responsibility and the responsibility of nation to provide necessary information and general awareness regarding reproductive health. Everyone mush known that:-

i) Marriage and child bearing during more mature stages of life are important for reproductive health of society.

ii) Secondary school education which is lagging behind in many parts must be enhanced.

iii) Complications during pregnancy and child birth and unsafe abortion are the causes of death of women. All these aspects of reproductive health have been considered by W.H.O and National population policy national policy of India.

The infectious (communicable) diseases which are spread from an infected to a healthy person by sexual contact are called S.T.D's(Sexually transmitted diseases).

The common among them are:-

i) **Gonorrhea:-** is caused by bacterium (Nisseria Gonorrhea). The victim feeling burning sensation and pain during urination. It causes inflammation of mucus membranes of primogenital tract, throat, eyes. The disease is easily curable by antibiotics.

ii) **Syphilis:-** is caused by a bacterium (Troponema Pallidum). The disease is the chronic illness which affects mucus membrane of genitals, rectum and oral regions and causes lesion. It is easily cured by antibiotics.

iii) **AIDS**:- Is caused by virus HIV. It is the fast spreading incurable disease which weakness the body's immune system. The main systems are:-

   i) Damage to brain.
   ii) Unexplained fever appetite.
   iii) Unexplained fever loss of
   iv) Loss of weight.
   v) Night sweats.
   vi) Shortness of breath.
   vii) Severe weakness.

It is transmitted only by the contact of infected cells containing blood of patient with the blood of healthy person like use of contaminated needles to inject drug or vaccine, use of contaminated razors for shaving transfusion of blood and blood products etc.

Q1) What are the different forms of power sharing in modern democracies? Give an example of each of these.

Ans: The different forms of power sharing in modern democracies are:

1. **Horizontal Form of Power:-** The power is shared among the different organs of government, such as the legislature, executive and judiciary. In this form of power sharing, the different organs of the government placed at the same level, exercise different powers. This separation of powers ensures that each organ should be limited to its own sphere of action without interfering in the matter of the others and the each should be independent within that sphere. Example: The distribution of power between Indian Parliament (legislature), the council of ministers headed by chief ministers (executive) and Courts of India (judiciary).
2. **Vertical Form of Power:-** It involves the division of powers between the higher and the lower levels of the government. In such a power sharing arrangement, the power is shared among the governments at different levels i.e. a general government for the entire country and the governments at the provincial or regional level. Example: In India, power is shared among Central government, State government and local governments.
3. **Power Sharing among different Social Groups:-** Power may also be shared among different social groups such as the religious and linguistic groups. This form of power sharing is used in many countries to give proper share of power to minority communities. Example: 'Community Government' in Belgium.
4. **Power Sharing among Political Parties, Pressure Groups and Movements:-** Political Parties, Pressure Groups and Movements control or influence those who are in power. Different political parties contest elections for power which ensures that power does not remain in one hand and shared among different political parties that represent different ideologies and social groups. Example: Multi-party system in India like B.J.P, I.N.C, B.S.P etc. Pressure groups and movements influence the decision making process like FICCI, Jamaat-e-Islaami, RSS, Hurriyat Conference, JKLF etc.

Q2) State one prudential reason and one moral reason for power sharing with an example from the Indian context.

Ans: A prudential reason for power sharing is that it helps to reduce the possibility of conflict between the various social groups. Since social conflict often leads to violence and political instability, power sharing is a good way to ensure political stability. Imposing the will of the majority community over others may look like an attractive option in the short run, but in the long run, it undermines the unity of the nation. In India, seats have been reserved in the Legislatures for the socially weaker sections keeping in mind the prudential reason for power sharing.

A moral reason for power sharing is that it upholds the spirit of democracy. In a democratic setup, the citizens too have a stake in governance. People have a right to be consulted on how they are to be governed. In India, the citizens can come together to debate and criticize the policies and decisions of the government. This in turn puts pressure on the government to re-design its policies and re-consider its decisions. This active political participation is in keeping with the moral reason for power sharing.

Q3) After reading this chapter, three students drew different conclusions. Which of these do you agree with and why? Give your reasons in about 50 words.

> ***Thomman – Power sharing is necessary only in societies which have religious, linguistic or ethnic divisions.***
> ***Mathayi – Power sharing is suitable only for big countries that have regional divisions.***
> ***Ouseph – Every society needs some form of power sharing even if it is small or does not have social divisions.***

Ans:

Q4) The Mayor of Merchtem, a town near Brussels in Belgium, has defended a ban on speaking French in the town's schools. He said that the ban would help all non-Dutch speakers integrate in the Flemish town. Do you think that this measure is in keeping with the spirit of Belgium's power sharing arrangements? Give your reasons in about 50 words.

Ans: This measure has not been taken in keeping with the spirit of Belgium's power sharing arrangement. As per the power sharing arrangement in Belgium, Dutch speakers and French speakers have stake in power. The Brussels government has equal representation from the French speaking people and the Dutch speaking people, which shows that both groups have to respect each other's rights. By banning French, there will be civil unrest in the country. Both the languages should be made acceptable in the town's schools as the main purpose of the power sharing arrangement is to maintain peace between the French and Dutch speaking constituencies. This bi-lingual education system will be a better way to integrate the people of the town. Hence, the Mayor of Merchtem is wrong in banning the French language in the schools.

Federalism

Q1) Point out one feature in the practice of federalism in India that is similar to and one feature that is different from that of Belgium.

Ans: ***Similar Feature:*** One similar feature in the Federalism of India and Belgium is that both the countries have federations in which two types of governments are there and out of these two governments, central government is more powerful as compared to state governments and the central government has to share its powers with the state governments.

Different Feature: There are three types of governments in Belgium. First one is central government, second type is state government and third type of government is community government which is elected by people belonging to one language community and which has powers related to issues like educational, cultural, linguistic etc.

But unlike Belgium, India has a local self government (Panchayats for villages and Municipalities for Cities) in addition to the central and state governments; and the state government has to share some of its powers with the local governments.

Q2) What is the main difference between a federal form of government and a unitary one? Explain with an example.

Ans: In a federal form of government, the central government shares its powers with the various constituent units of the country. For example, in India, power is divided between the government at the centre and the various state governments. The division of powers between the union and the state government is provided under Article 245 and 246 and three legislative lists in the Seventh Schedule. The first is the Union List which consists of 100 subjects over which the Union Parliament has exclusive law-making power. The second is the State List which consists of 61 subjects over which State Legislatures have exclusive law making power. The third is the Concurrent List which consists of 52 subjects. Both the centre and the state can legislate on the subjects mentioned in the Concurrent List.

In a unitary form of government, all the power is exercised by only one government. For example, in Sri Lanka, the national government has all the powers. There is no constitutional provision for division of powers between the central and the provincial governments. The authority of the central government runs in all the provincial and local administration in Sri Lanka.

Q3) State any two differences between the local government before and after the Constitutional Amendment in 1992.

Ans: The two differences between the local government before and after the Constitutional Amendment in 1992 are listed as under:

i) The Panchayats in villages and the municipalities in the urban areas were set up in all the states. But these were directly under the control of state governments. Elections to these local governments were not held regularly. But after the Constitutional Amendment in 1992, it is constitutionally mandatory to hold regular elections to the local government bodies. Seats are reserved in the elected bodies for women, the scheduled castes, scheduled tribes and other backward classes. An independent institution called the State Election Commission has been created in each state to conduct Panchayats and Municipal elections.

ii) Local governments did not have any powers or resources of their own. There was very little decentralization in effective terms. But after the Constitutional Amendment in 1992, the state governments are required to share some powers and resources with local government bodies. The nature of sharing varies from state to state.

Q4) Here are three reactions to the language policy followed in India. Give an argument and an example to support any of these positions.
Sangeeta: The policy of accommodation has strengthened national unity.
Arman: Language based states has divided us by making everyone conscious of his her language.
Harish: This policy has only helped to consolidate the dominance of English over all other languages.

Ans: Sangeeta's reaction is better than those of the other two. Unlike Sri Lanka, where the language of the majority has been promoted, the Indian policy has given equal status to all the major languages spoken in the country. This has led to the avoidance of social conflict on linguistic basis. The policy of accommodation has made the administration of the states easier. The language policy of India is an attempt to instill a sense of respect of others' culture and this has definitely helped in strengthening national unity.

Q5) The distinguishing features of a federal government is:
(a) National government gives some powers to the provincial government.
(b) Power is distributed among the legislature, executive and judiciary.
(c) Elected officials exercise supreme power in the government.
(d) Government power is divided between different levels of government.

Ans: Answer to this question is option (d) that governmental power is divided between different levels of government. We can take example of India where powers are divided in Central government, State government and Local self governments.

Democracy and Diversity

Q1) Discuss three factors that determine the outcomes of politics of social divisions.

Ans. The factors that determine the outcomes of politics of social divisions are listed as under:

i) **<u>The people's perception of the identities:-</u>** The outcome depends on how people perceive their identities. If they see themselves as having unique and exclusive identities, it would be very difficult to integrate different groups into one compact group. In other words, as long as the Irish people see themselves as either catholic or protestant and not as citizens of Ireland, their differences would be difficult to settle.

ii) **<u>Raising of demands by political leaders:-</u>** The second observation about politics of social division concerns how political parties led by leaders create friction between different ethno-religious groups. Just to further their own political ambitions. If the interests of the political leaders do not coincide with the interests of the groups for which they are fighting, then things may get even more complicated. Further, if leaders of different groups raise their demands within the constitutional framework, then it would be easy to reconcile the interests of different social groups. Thus, in Sri Lanka, the demand for "only Sinhala" at the cost of the interests of Tamil is, quite understandably, an indigestible demand. As long such demands persist, peaceful co-existence between the two communities can never come about.

iii) **Reaction of the government to the demands of different groups:-** The third observation is related to how government reacts to the demands raised by different social groups. Take the example of Sri Lanka in the light of the Belgian experience; if the government responds positively to the demands of different minority groups for autonomy in power sharing, then chances of violent conflicts would be minimized. But if government tries to suppress such demands, the end result would be quite the opposite, i.e. violent.

Q2) When does a social difference become a social division?

Ans.The meaning of social difference is the difference in a group due to certain bases like race, region, religion, caste, colour, culture, language, gender etc. Social division takes place when some social difference overlaps with other differences. In other words, a social difference becomes a social division when it coincides with other social differences, which in turn serve to heighten the said difference. For example: in Northern Ireland, religion and social class (social status) overlap each other. Northern Ireland is predominantly a Christian country with two segments- Catholics and Protestants. The catholic segment is relatively inferior in social status and faces social discrimination, while Protestants are relatively wealthier and enjoy higher social status.

Q3) How do social divisions affect politics? Give two examples.

Ans.**Negative effect:-** The politics of a country cannot remain untouched by social divisions. The combination of social divisions and politics can be really dangerous. A democracy involves competition among various political parties. Their completion tends to divide any society, if they start competing in terms of some existing social divisions, it can make social divisions into political divisions and lead to conflict, violence or even disintegration of a country.

An example of this is the political competition along religious and ethnic lines led to the disintegration of Yugoslavia into six independent countries.

Positive effect:- The combination of social divisions and politics is not always negative. In a democracy, it is natural that political parties would talk about these divisions, make promises to different communities, look after due representation to redress the grievenances of the disadvantaged communities. For example, the system of reservation of seats in the Indian Legislatures for the socially disadvantaged has allowed such social groups to have an adequate representation in the decision making process.

GENDER, RELIGION & CASTE

Q#1 Mention different aspects of life in which women are discriminated or disadvantaged in India.

Ans. In India, women are discriminated and disadvantaged in the following ways:-

1. Women are not provided adequate education. The literacy rate among women is only 65.46% compared with 82.14% among men. They usually drop out from the educational institutions because their parents prefer to spend their resources for their boy’s education rather than spending equally on their sons and daughters.
2. The proportion of women among the highly paid and valued jobs is still very small. On an average, an Indian woman works one hour more than an average man every day. Yet much of her work is not paid and therefore often not valued.
3. The equal wages Act provides that equal wages should be paid to equal work. However, in almost all areas of work, from sports and cinema, to factories and fields, women are paid less than men, even when both do exactly the same work.
4. In many parts of India, parents prefer to have sons and find ways to have the girl child aborted before she is born. Such practices have led to a decline in child sex ratio in the country to merely 927 girls per thousand boys. There are reports of various kinds of harassment, exploitation and violence against women.

Q#2 State different forms of communal politics with one example each.

Ans. Communalism can take various forms in politics. Some of these are listed as under:

i) **Communalism in daily beliefs:-** The most common expression of communalism is in everyday beliefs. These routinely involve religious prejudices, stereotypes of religious communities and belief in the superiority of one's religion over other religions. This is so common that we fail to notice it, even when we believe in it. Religious Groups present in many parts of India are a good example of this.

ii) **Formation of political parties based on religious communities:-** A communal mind often leads to a quest for political dominance of one's own religions community. For those belonging to the majority community, this takes the form of majoritarian dominances. For those belonging to the minority, it can take the form of a desire to form a separate political unit. Separatist leaders and political parties in many parts of India are an example of this.

iii) **Political mobilization on religious lines:-** Political mobilization on religious lines is another frequent form of communalism. This involves the use of sacred symbols, religious leaders and emotional appeals in order to bring the followers of one religion together in the political arena. For example, this technique is applied by many politicians to influence voters from the largest religious communities in the country.

iv) **Communal Riots:-** Sometimes communalism takes its most ugly form of communal violence, riots and massacre. India and Pakistan suffered some of the worst communal riots at the time of the partition. The post-independence period has also seen large scale communal violence. The riots in Gujarat in 2002 is an example of this.

Q#3 State how caste inequalities are still continuing in India.

Ans. Caste inequalities have not completely disappeared from contemporary India. Some of the older aspects of caste have persisted. Even today most people marry within their own caste or tribe, even it is legally sanctioned, and they do not like to marry out of their caste. Effects of centuries of advantages and disadvantages of caste continue to be felt today. The caste groups that had access to education under the old system have done very well in acquiring the modern education while those groups that did not have access to education have naturally lagged behind. Consequently, the poor are mostly the low castes while the rich are the high castes, thereby showing that caste inequalities are still continuing in India. Despite constitutional prohibition, untouchability has not ended completely.

Q#4 State two reasons to say that caste alone cannot determine election results in India.

Ans. In modern politics caste alone cannot determine the election results in India because of the following reasons:-

i) No parliamentary constituency in the country has a clear majority of one single caste. So every candidate and party needs to win the confidence of more than one caste community to win elections.

ii) These days people belong to different political parties instead of caste. They like to cast their vote to their favourite political party instead of caste. Moreover, the ruling party and the sitting MP or MLA frequently lose elections in our country. It could not have happened if all castes and communities were frozen in their political preferences.

Q#5 What is the states of women's representation in India's legislative bodies?

Ans. In India, the proportion of women in the Legislative bodies has been very low. In this respect, India is among the bottom group of nations in the world. In every election the share of women's winning percentage in Parliament never exceed than 10% and their representation in state assemblies is as low as 5%. In the whole sphere of the world, India is at the bottom of the list in women's representation in legislative assemblies. In the 2014 Lok Sabha elections, the percentage of women in the Indian parliament is around 12%. It still remains far below the global average of around 21%. Even if female heads the government then the cabinet is dominated by males. On the other hand, the situation is different in the case of local government bodies. As one-third of seats in local government bodies is reserved for women. There are more than 10 lakhs elected women representatives in rural and urban local bodies.

Q#6 Mention any two constitutional provisions that make India a secular state.

Ans. The Constitution of India has provided a status of Secular State to the nation due to diversity of religions in it. The two constitutional provisions that make India a secular state are as under:-

i) There is no official religion for the Indian state. Unlike the status of Buddhism in Sri Lanka, that of Islam in Pakistan and that of Christianity in England, the Indian constitution does not give a special status to any religion.
ii) The Constitution provides to all individuals and communities, the freedom to profess, practice and propagate any religion or not to follow any. It also says that government shall not discriminate with any citizen on the basis of his religion. That's why the many key positions of the country, President, Vice President and Prime Minister, are held by the people who belong to minority religion.

POPULAR STRUGGLES AND MOVEMENTS

Q.1) In what ways do pressure groups and movements exert influence on politics?

Ans. The pressure groups and movements exert influence on politics in the following ways:-

(i)They try to gain public support and sympathy for their goals and activity by carrying out information campaigns, organizing meetings, filing petitions, etc. Most of these groups try to influence the media in order to get more attention to these issues.

(ii) They often organize protest activity like strikes or disrupting government programmes. Worker's organizations, employee's associations and most of the movement groups often resort to these tactics in order to force the government to take note of their demand.

(iii) Business groups often employ professional lobbyists or sponsor expensive advertisements. Some persons from pressure groups or movement groups participate in official bodies and committees that offer advice and suggestions to the government.

(iv) While interest groups and movements do not directly engage in party politics, they seek to exert influence on political parties. Most of the movement groups take a political stance without being a party. They have political ideology and political position on major issues.

Q.2) Describe the forms of relationship between pressure groups and political parties.

Ans. The relationship between pressure groups and political parties can take different forms which are listed as under:

(i) In some instances, the pressure groups are either formed or led by the leaders of political parties. For example, most trade unions and student's organizations in India are either established by or affiliated to one or the other major political party.
(ii) Sometimes political parties grow out of movements. For example, the 1931 uprising in J&K gave rise to the Muslim Conference which in 1938 transformed into the Secular National Conference.
(iii) Many a times, the issue raised by the pressure or movement groups are taken up by the political parties, leading to a change in the policies of the parties.

Q.3) Explain how the activities of pressure groups are useful in the functioning of a democratic government.

Ans. Pressure groups help in the deepening of democracy as they provide an opportunity for marginalized people to express their opinions. Putting pressure on the rulers is not an unhealthy activity in a democracy as long as everyone gets this opportunity. Governments can often come under pressure from a small group of rich and powerful people. Pressure groups perform a useful role in countering the undue influence and reminding the government of the needs and concern of ordinary citizens. As a result, the government comes to know what different sections of the population want. This leads to a fair balance of power and accommodation of conflicting interests.

Q.4) What is a pressure group? Give few examples.

Ans. A pressure group is an organized association that aims to influence the policies or actions of the government. These organizations are formed when people with common occupation, interest, aspirations or opinions come together in order to achieve a common objective. Examples of pressure groups are Narmada Bachao Andolan, Movement for Right to Information, Anti-liquor Movement, Women's Movement, FEDECOR, BAMCEF etc.

Q.5) What is the difference between a pressure group and a political party?

Ans. Pressure groups differ from political parties as these groups seek to promote their interests rather than to win or exercise government power. On the other hand, the political parties contest elections because their aim is to achieve political power. Further, pressure groups typically have a narrow issue focus. They are usually concerned with a specific cause or the interests of a particular group. They seldom have the broader programme that is generally associated with the political parties.

THE JAMMU AND KASHMIR REORGANISATION ACT, 2019.

Qno1. What do you mean by the Jammu and Kashmir Reorganisation Act, 2019?

Ans: The Jammu and Kashmir Reorganisation Act, 2019 is an act which got passed in the Parliament of India on 6th August 2019. President of India assented it for implementation on 9th August 2019. Under this act the erstwhile Jammu and Kashmir was bifurcated into two Union Territories. Ladakh became one union territory and Jammu and Kashmir became another union territory. Under this Act, the Central Government has total control and power of administration over both Union Territories. The Act came into effect on 31st October 2019.

Qno2. What is an Instrument of Accession?

Ans: Instrument of Accession is a legal document through which the Jammu and Kashmir state was incorporated with the Union of India. The Instrument of Accession in short form is also called as IOA. It was signed by the then Maharaja Hari Singh and the then Governor General of India, Lord Mountbatten on 26th & 27th October, 1947. Because Maharaja Hari Singh has put his signature on the Instrument of Accession on 26th October and Lord Mountbatten signed it on 27th October. It was through this Instrument of Accession, Jammu and Kashmir State was incorporated with the Union of India but with a condition that the Government of India can make laws only in certain cases like Defence, Communication and External Affairs. Thus, Maharaja Hari Singh handed this Instrument of Accession to Lord Mountbatten ending the saga of the remarkable 100 years of Dogra Rule.

Qno3. Write a short note on Article 370.

Ans: Article 370, along with article 35A, defined that the residents of J&K State shall reside under a separate set of laws, including those related to Citizenship, Ownership of Property and Fundamental Rights as compared to the residents of other States. Article 370 was incorporated in the constitution of India. Under IOA and gave special status to J&K conferring it with certain powers like

I. Separate constitution,

II. State flag,

III. Autonomy over the internal administration of the state,

IV. Article 238 of Indian Constitution was not applicable to the State of Jammu and Kashmir whereas it was applicable to all other States of India.

Qno4. Write a short note on Article 35A.

Ans: Article 35A of the Indian Constitution was an article that empowered the J&K State legislature to define the status of permanent residents of the State. The Constitutional safeguards provided under Article 35A were in continuance of the special privileges granted to the residents of Jammu and Kashmir under hereditary State Subject Order of 1927 passed by Maharaja Hari Singh. The Article was incorporated in the

Constitution of India through a presidential order "The constitution order (Application to J&K) 1954, issued by the President of India on 14 May 1954 under article 370. The J&K Reorganization Act of 2019 came into effect on 31st of October, 2019and thereupon superseded the Constitution (application to J&K) order, 1954 as amended from time to time.

Qno5. What are the provisions of the Jammu and Kashmir Reorganization Act, 2019.

Ans: The Jammu and Kashmir Reorganisation Act, 2019 is an act which got passed in the Parliament of India on 6th August 2019 after the assent of the President of India which led to the bifurcation of the erstwhile state of Jammu and Kashmir into two Union Territories. The provisions of the Jammu and Kashmir Reorganization Act, 2019 are as under:

1. Formation of Union Territory of Ladakh: There shall be formed a new territory to be known as the Union Territory of Ladakh comprising the territory of Kargil and Leh Districts of the erstwhile State of Jammu and Kashmir and thereupon the territory shall cease to be a part of Jammu and Kashmir. It came into being on 31st of October 2019. The UT of Ladakh will be without legislature and under the direct control of President of India and shall be administered through a lieutenant Governor.

2. Formation of Union Territory of Jammu & Kashmir: New Union territory known as the U.T of Jammu and Kashmir, comprising the territory of the existing State of J&K other than the Kargil & Leh Districts. It came into being, on 31st of October 2019. The UT of J&K shall have a legislative Assembly and shall be under the direct control of president of India administered through a Lieutenant Governor. The J&K U.T shall have Ministerial Council consisting of 8 ministers headed by Chief Minister. There shall be no Legislative Council for the Union Territory of J & K.

3. Reservation: There shall be reservation for scheduled castes, scheduled tribes, OBCs and others as per Central Government's Rules in both the Union Territories.

4. Application of Central Laws: All the Central laws shall now be applicable to both J&K and Ladakh U.Ts. 106 central laws shall become applicable with immediate effect.

5. Common High Court for both Union Territories: The High Court of J & K shall function as the high court for both the U.Ts.

POLITICAL PARTIES

Qno.1) State the various functions political parties perform in a democracy.

Ans. The following are the three types of political parties:-

(i) **Parties contest elections:-** In democracies, elections are fought mainly among the candidates put up by political parties. Parties select their candidates in different ways. In India, top party leaders choose candidates for contesting elections.

(ii) **Parties form policies and programmes:-** Parties put forward different policies and programmes and the voters choose from them. Each of us may have different opinions and views about the policies whether they are suitable for the society or not. But no government can handle such a large variety of views. In such a situation, a political party plays a very important role by reducing a vast multitude of opinions into a few basic positions which it supports.

(iii) **Parties play a role in making laws:-** Parties play a decisive role in making laws for a country. Formally, the laws are debated and passed in the legislature. The members of the ruling party follow the directions of the party leaders, irrespective of their own personal opinions.

(iv) **Parties form and run the government:-** Policy decisions whether big or small are taken by political executive that comes from the political parties. Parties recruit leaders, train them and make them ministers, to run the government in the way they want.

(v) **Parties play a role of opposition:-** Those parties that lose in the elections play the role of opposition against the parties in power by criticizing the government for its failure or wrong policies.

(vi) **Parties shape public opinion:-** Parties have lakhs of members and activists spread all over the country. Many of the pressure groups are the extensions of political parties among different sections of society. They raise and highlight issues prevalent in the society. Parties sometimes also launch movement for the resolution of problems faced by the people.

(vii) **Parties provide people access to government machinery and welfare schemes:-** For an ordinary citizen it is easy to approach a local party leader than a government officer. That is why they feel close to parties even when they do not fully trust them. Parties have to be responsive to people's needs and demands. Otherwise people can reject them in the next elections**.**

Qno.2) What are the various challenges faced by political parties?

Ans. The various challenges faced by political parties can be listed as under:-

1. **Lack of internal democracy:-** All over the world there is a tendency in political parties towards the concentration of power in one or few leaders at the top. Parties do not keep membership registers, do not hold organizational meetings, and do not conduct internal elections regularly. Ordinary members of the party do not get sufficient information about what happens inside the party. They do not have the means or the connections needed to influence the decisions. As a result the leaders assume greater power to make decisions in the name of the party.
2. **No transparency:-** Most political parties do not practice open and transparent procedures for their functioning. As such there are very few ways for an ordinary worker to rise to the top in a party. Those who happen to be the leaders are in a position of unfair advantage to favour people close to them or even their family members. In many parties, the top positions are always controlled by members of one family. This is unfair to other members of that party. This is also bad for democracy because people who do not have adequate experience or popular support come to occupy positions of power.
3. **Money and muscle power:-** Since parties are focused only on winning elections, they tend to use short-cuts to win elections. They tend to nominate those candidates who have or can raise funds for the party. Rich people and companies that give funds to the parties tend to have influence on the policies and decisions of the party. In some cases, parties support criminals who can win elections. Democrats all over the world are worried about the increasing role of rich people and big companies in democratic politics.
4. **No meaningful choices to the voters:-** In order to offer meaningful choice parties must be significantly different. In recent years, there has been a decline in the ideological differences among parties in most parts of the world. Those who really want different policies have no option available to them. Sometimes people cannot even elect very different leaders either because the same set of leaders keep shifting from one party to another.

Qno.3) Suggest some reforms to strengthen parties so that they perform their functions well?

Ans. Some reforms which could strengthen the political parties are as under:-

a) A law should be made to regulate the internal affairs of the political parties. It should be made compulsory for the political parties to maintain a register of its members, to follow its own constitution, to have an independent authority, to act as a judge in case of party disputes, to hold open elections to the highest posts.
b) It should be made mandatory for the political parties to give a minimum number of tickets, about one-third, to women candidates. Similarly, there should be a quota for women in the decision making bodies of the party.
c) There should be funding of elections. The state should fund election campaigns, thereby eliminating lobbying groups and unfair competition. This support could be given in kind i.e. petrol, paper, telephone etc. or could be given in cash on the basis of the votes secured by the party in the last election.
d) Ordinary citizens, pressure groups, movements and the media can play an important role by pressurizing political parties to bring in reform. This can be done through petitions, publicity and agitations. If political parties feel that they would lose public support by not taking up reforms they would become more serious about reforms.

Qno.4) What is a political party?

Ans. A political party is a group of people who come together to contest elections and hold power in the government. They agree on some policies and programmes for the society with a view to promote the collective good. Since there can be different views on what is good for all, parties try to persuade people why their policies are better than others. They seek to implement these policies by winning popular support through elections. By competing in elections parties offer citizens a choice in governance, and while in opposition they can hold governments accountable. The primary role of the political party is to fix the political agenda and policies.

Qno.5) What are the characteristics of a political party?

Ans. The characteristics of a political party are as under:

(i) Political parties are groups of well organized likeminded people with the same views and opinions who come together to contest elections and hold power in the government.
(ii) The members of the political party agree on some policies and programmes for the benefit of society with a view to promote collective good.
(iii) Every political party has one common aim and that is to attain power in one way or another. For this they contest elections and try to win. If they single handedly are unable to win a majority, they make an alliance with other parties to form a coalition government.
(iv) Political parties try to persuade people that their policies are better than those of other parties.
(v) Parties are a part of society. They represent and support particular views or policies that would be supported by a part of the society and its interests. Thus political parties involve partisanship.

OUTCOMES OF DEMOCRACY

Qno1) How does democracy produce an accountable, responsive and legitimate government?

Ans: Democracy is an accountable form of government as all the citizens have the right to choose their rulers and control over them. The democratically elected government is answerable to people. If the government does not function as per the wishes of the people it would likely lose in the next election and would be thrown out of power. Whenever possible the citizens are able to participate in the decision making through formation of public opinion. Hence, the government needs to be accountable to people.
Similarly the government has to be responsive to the problems and aspirations of the people, otherwise people would choose the next better alternatives in the next elections because the democracy provides them the arrangement of regular, free and fair election and conditions for open debates.
Democracy has a legitimate government as it is elected by the people through elections. The authority of the government is based on the will of the people. It is the people who elect the government on their behalf to rule them. Thus, how far a government is legitimate in a democracy is dependent on the will and the consent of the people.

Qno2) What are the conditions under which democracies accommodate social diversities?
Ans: In most of the countries, social diversity generally exists. Every society is diverse in many ways like religion, race, caste, creed, culture etc. Democracy is considered to be the most suitable form of government to accommodate these diversities. A democratic government gives adequate representation to all groups and makes every group feel that their existence is recognized and that full justice is being done to them. Democracy ensures majority rule and at the same times safeguards the rights of minorities. In democracy minorities are given freedom to form associations and special educational rights are granted to certain minority communities. In a democracy, there should be a number of political parties and interest groups to participate in the political process. These parties shape public opinion and thus, force the government to work according to the will of the people. Power keeps on shifting among political parties and political groups so that it may not be monopolized by a section of people, as happens in a communist country. Thus, democracy accommodates social diversity in order to achieve a viable decentralized society.

Qno3) Give arguments to support or oppose the following assertions:

(a) ***Industrialized countries can afford democracy but the poor need dictatorship to become rich:*** Although examples of many countries under dictatorship suggest that economic growth can be good in such countries, yet some democracies are much better so far their economic condition is concerned. Many poor countries of the past have progressed under the democratic rule, although the growth may have been slow. Looking at the cost benefit analysis it can be said that even for a poorer country, democracy is always a better option rather than dictatorship to strive for becoming rich.

(b) ***Democracy can’t reduce inequality of incomes between different citizens:*** This is a true reality that inequality of incomes cannot be reduced between different citizens, no matter which type of government system is in place. Even the past experience of Socialism in Russia and China suggest that it is almost impossible to create a society where everyone is equal in terms of economic power. The same holds true for democracy also.

(c) ***Government in poor countries should spend less on poverty reduction, health, education and spend more on industries and infrastructure:*** While it is always prudent to spend on industries and infrastructure for better employment generation, the role of social security cannot be ignored. There are many people who are so poor and oppressed that they need some sort of help to improve their condition. Poverty eradication, health benefits and education schemes should be always in place to help such people. A proper balance should be maintained in spending on social security and on industries.

(d) ***In democracy all citizens have one vote, which means that there is absence of any domination and conflict:*** In theory, it is true that the formula of one person one vote negates the effect of domination and conflict. But in the real world, a society can be very complex. It is the basic instinct of the people to dominate others at the very first

opportunity. Similarly, conflicts are bound to arise in a society. However, democracy minimizes the effect of such tendency to certain extent.

Qno4) Identify the challenges to democracy in the following descriptions. Also suggest policy / institutional mechanism to deepen democracy in the given situations:

(a) Following a High Court directive a temple in Orissa that had separate entry doors for dalits and non-dalits allowed entry for all from the same door.

This example shows the challenge about practicing untouchability or casteism that was banned by the constitution. In this case, the judiciary interfered in the matter and right to equality was enforced. Casteism should be eradicated from India with the help of education and awareness programmes.

(b) A large number of farmers are committing suicide in different states of India.

Here the challenge is poverty. The government has to provide economic equality by promoting agriculture and diversity in agriculture, so that it raises the economic standard of the farmers.

(c) Following allegation of killing of three civilians in Gandwara in a fake encounter by Jammu and Kashmir police, an enquiry has been ordered.

Here the challenge is the security of the citizens. These incidents can be avoided by practising transparency in the Police Department and their actions. The government should promote human rights.

Manufacturing Industries Geography

Short answer type questions:-

Q.1 Define manufacturing.

Ans manufacturing is the processing of primary products into more refined and usable products. Many of the natural resources cannot be utilized directly without processing. Therefore we manufacture cloth from cotton, sugar from sugarcane, paper from wood pulp and petro-chemical from mineral oil. By doing so we make the primary products more valuable and usable. In other words, manufacturing means transformation of natural material endowments into commodities of utility by processing, assembling and repairing.

Q.2 How is raw material an important geographical factor in the location of an industry?

Ans Location of an industry is influenced by many geographical factors among which availability of raw material is of utmost importance and its significance in manufacturing industry is so fundamental that it needs no explanation.

Indeed the location of industries enterprises is sometimes determined simply by location of the raw materials for e.g industries which use heavy and bulky raw material in their primary stage in large quantities are usually located near the supply of the raw materials. This enables minimum transportation cost of the raw materials. This is the major reason behind the fact that one of the most important industries i.e. iron and steel industry which uses coal and iron ore as its two basic raw materials are located at three distinct places vix.

1) Near coal fields
2) Near iron ore mining centres and
3) At place between areas of coal and iron ore production.

Q.3 Market is an important vocational factor in the establishment of an industry. Explain.

Ans The entire process of manufacturing is useless until the finished goods reach the market. Nearness to market is essential for quick disposal of manufactured goods. It helps in reducing the transport cost and enables the consumers to get things at cheaper rates. It is becoming increasingly evident that industries are seeking locations as near as possible to their markets to save overall production cost.

Q.4 Write a short note on cotton textile industry of India.

Ans Cotton textile industry is one of the oldest industries in India. Spinning and weaving were the earliest crafts of primitive man. The industry once its rapid development to industrial revolution in England.

Many spinning and weaving machines were invented. These inventions changed this industry from a house hold to mill industry.

India had a glorious past of cotton textile industry. The first modern cotton textile mill was set up in 1818 at fort glister near Kolkata. But this mill could not survive and had to be closed down. However the first successful modern cotton textile mill was established in Mumbai in 1854. The real expansion of cotton textile industry took place in 1870's.

At present cotton textile industry is largest organized modern industry of India. There has been a phenomenal growth of this industry during the last four decades. About 16 percent of the industrial capital over 20 percent of the industrial labour of the country is engaged in this industry. The total employment in this industry is well 15 million workers.

Although cotton textile mills are located in over 80 towns and cities of India yet its larger concentration is found in Maharashtra, Gujarat, West Bengal and Uttar Pradesh.

Q.5 Differentiate between private sector industry and public sector industry.

Ans

Public Sector Industry	**Private Sector Industry**
1. The section of a nation's industrial sector which is under the control of govt. whether it is central, state or local is known as public sector. 2. Its basic objective is to serve the citizens of the country. 3. For e.g. Bharat heavy. Electrical ltd, NHPC, NTPC, ONGC etc.	1. The section of nations' industrial sector which is owned and controlled by private individual or companies is called private sector. 2. Its basic objective is to earn profit. 3. For e.g. Bajaj Auto, Reliance, TISCO etc.

Q.6 What are the major industrial regions of India and name five of them.

Ans Industries are unevenly distributed in India because the factors affecting industrial location are not the same everywhere. Industries tend to concentrate in a few pockets because of certain favorable factors. The pockets having high concentration of industrials are known as industrial regions. It can be classified into three categories.

1. Major industrial region is identified on the basis of a minimum daily factory working force of 1.5 lakh.
2. Minor industrial region must have a minimum of 25000 working labour force.
3. Manufacturing district has a working labour force of less than 25000. Following are the major industrial regions of India.
    i. Mumbai Pune industrial region.
    ii. Hoogli industrial region.
    iii. Banglore Tamil Nadu industrial region
    iv. Gurgaon Delhi Meerut industrial region.

Q.7 Write short note on handicrafts in Jammu and Kashmir.

Ans Handicrafts occupy an important position in J & K . the state provides a friendly environment for these labour intensive activities. The carpets of Kashmir are highly priced world over. Most of the carpets produced in Kashmir are exported to foreign countries in middle east and Europe. The handicrafts from J & K have been in demand the world over. Wood carvings, shawls, paper machine, woolen shawls, crewel embroidery, baskets, wall hangings, Namdas and Gabba, special type of woolen carpets, jewellery etc hold a significant share in export of the state.

Handicraft industry in j & K is unique in terms of design cost and quality of products and there provides a competitive advantage on other national and international players of handicraft market. Inspite of various advantages, the industry still needs to explore and identify various opportunities and challenges ahead to complete at national as well as at global level markets.

Long answer type questions:-

Q.1 What are the geographical, now geographical factors which influence the location of an industry?

Ans Location of industry is influenced by many geographical factors. However there are several non geographical factors of historical, political and economic nature which also influence the non geographical factors which also influence the location of industries across the world. However the factors influencing the location of industry can be divided into two road categories: geographical factors and non geographical factors.

Geographical factors:-

1. **Raw Material:-** It is the most important geographical factor and its significance in manufacturing industry is so fundamental that is needs no explanation. Large quantities of raw material are needed for industries. Therefore industries are located near sources of raw materials. It saves the cost of transportation e.g. iron and steel industries are located where coal and iron are easily available

similarly jute mills in west Bengal and cotton textile mills in Maharashtra are located due to the availability of the raw materials.

2. **Power: -** Regular and supply of power is prerequisite for the localization of industries. Coal, mineral oil and hydro electricity are the three important conventional sources of power. Most of the industries tend to concentrate at the source of power. The iron and steel industry which mainly depends on large quantity of cooking coal as source of power are frequently tied to coal fields.
3. **Labour:**- Labour supply is important in two respect
   a) Workers in large numbers are often required
   b) People with skill or technical expertise are needed. In our country modern industry still require a large number of workers inspite of increasing mechanization.
4. **Transport**: - Transport by land or water is necessary for the assembly of raw material and for the marketing of the finished goods. Cheap, developed and quick means of transportation is required for the movement of workers, raw materials and machinery.
5. **Market: -** The entire process of manufacturing is useless until the finished goods reach market. Nearness to market is essential for quick disposal of manufactured goods. It helps in reducing the transportation cost and enables the consumer to get things at cheaper rates.

Non Geographical Factors:-

1. **Capital: -** Modern industries are capital intensive and require huge investments. Big cities like Mumbai, Kolkata, Delhi and Chennai are big industrial centres because the big capital is live in these cities and there is easy availability of capital.
2. **Banking facilities: -** Establishment of industries involve daily exchange of crores of rupees which is possible through banking facilities only. So the areas with better banking facilities are better suited to the establishment of industries.
3. **Insurance: -** There is a constant fear of damage to machinery and men in industries for which insurance facilities are leadly needed. The destruction caused by September 2014 floods in J & K is a recent example in this regard.
4. **Highly professional management and skilled: -** Man power is an important component in the fast it and e commerce industry due to which it gets concentrated in certain flavoured. Pockets such as Bangalore, Hyderabad and pune.

Q.2 Highlight the importance of iron steel industry in India. What are the factors influencing its location?

Ans India being a developing country, iron and steel industry has a very important role to play. The manufacture of steel is regarded as one of the key industries. It is a prerequisite for modern industrial development.

Large amounts of iron and steel is required for constructing bridges, rail tracks, ships, vehicles, variousmachines, power plants, air ports etc.

The basic need of Indian economy today is rapid industrialization. As important industries like railwaylocomotives, ship building, heavy and light machine, construction etc. depend on the availability of iron and steel, industry accelerates industrialization and is therefore called the backbone of all industries.

Factors influencing the location of iron and steel industry.

Iron and steel industry uses large quantities of heavy and weight losing raw materials and its localization is primarily controlled by the availability of raw materials. Coal and iron ore are the two basic raw materials used by iron and steel industry. On the basis of minimum transportation cost most of the steel plants are located at three distinct places viz

i. Near coal fields.
ii. Near iron ore mining centres and
iii. At places between areas of coal and iron ore production.

Most of the iron and steel plants of India such as Jamshedpur, Burnpur, Durgapur, Rourkela, Bhilai and Bokaro are located in Jharkhand, West Bengal, Orissa and Chhattisgarh. These states are very rich in coal and iron ore deposits and are important producers of these minerals.

Q.3 Discuss in detail the development, distribution and importance of textile industry of India.

Ans Textile industry includes cotton, jute, wool, silk and synthetic fiber textiles. India is one of the leading producers of textile goods. It is one of the largest and most important sector in the economy in terms of out put, foreign exchange earning, and employment in India. Its contribution forms 20% of the industrial production 10 % of the excise collection, 18% of employment in the industrial sector 20% of the country's total export earning and 4% of the GDP.

1. **Cotton textile industry:-** The first modern cotton textile mill was set up in 1818 at fort glister near Kolkata. But this will could not survive and had to be closed down. The first successful modern cotton textile mill was established in Mumbai in 1854. The real expansion of cotton textile industry took place in 1870's. At present cotton textile industry is largest organized modern industry of India. About 16% of the industrial capital and over 20% of the industrial labour of the country is engaged in this industry.Although cotton textile mills are located in over 80 towns and cities of India yet its largest concentration is found in Maharashtra, Gujarat, West Bengal and Utter Pradesh.

   Mumbai is the largest centre of India having 63 cotton mills out of Maharashtra total of 122 mills Gujarat is the second largest producer of cotton textiles after Maharashtra. Ahmadabad is the second largest centre of cotton textile industry after Mumbai.
2. **Jute textiles industry**: - India is the largest producer and second largest exporter of jute goods in the world, contributing 35% of the total output of the world. It is a labour intensive industry which directly and indirectly provides job to more than 4 lakh people.

   The first jute factory in India was established at Rishira near Kolkata in 1854. The industry made tremendous progress in the later part of the 19th century. This industry however suffered a serious set back in 1947 due to the partition. After partition about 80% of the jute growing areas went to east Pakistan (Bangladesh) while as 90% jute mills remained in India. At present there are only 79 jute producing mills in India. Most of these mills are along the Hugli River especially to the north of Kolkata. Out of total 79 jute mills 62 are located in west Bengal, 3 each in Bihar and Uttar Prades, seven in Andhar Pradesh and one each in Assam, Orrisa, Tripur and Chatisgarh.
3. **Woolen textile industry**: - Woolen textile is one of the oldest textile industry of India. The modern woolen textile industry started at Kanpur in 1876. It was followed by the setting up of dhariwal at Punjab in 1881. Subsequently woolen mills were established in Mumbai and Bangalore. The industry made tremendous progress after independence. The main concentration of woolllen textile industry is found in Punjab, Maharashtra and Uttar Pradesh. Other states which are producing woolen goods are Gujrat, J&K Karnataka and West Bengal.
4. **Silk textile industry**: - India is the second largest producer of silk in the world after china. There are about 90 silk textile mills and also several small and medium units engaged in the production of silk textiles. More than 9/10th of the production comes from Karnataka, West Bengal and J and K. Main silk manufacturing centres in Karnataka are Bangalore, Kolar, Mysore and Belgaum, Murshid Abad and Bankura in West Bengal, Anantnag, Baramulaand Srinagar in J&K.

   Synthetic textile industry:-Human made fibre form an important segment of our textile industry. Special qualities like strength , durability and workability of synthetic fibres revolutionsed the textile industry. Four well known synthetic fibres produced in India are rayon, nylon, terune and decron.
   They are served form wood pulp and petro chemicals. This industry is well established in Gujrat, Maharashtra, Kerala and Tamil Nadu.

Q.4 Discuss in detail the growth and importance of petroleum industry in india.

Ans refining industry: there are already 21 refineries in the country. Important refineries include i) Barauni (Bihar) ii) Mumbai (iii) Cochin (Kerala) iv) Digboi (Assam) (v) Guwahati(Assam) (vi) Haldia (West Bengal) vii) Mumbai (viii) Vishakhapatnam (Andhara Pradesh) ix) Koyali (Gujarat) (x) Chennai (Tamil Nadu) (xi) Mathura (Uttar Pradesh) (xii) Panipat (Haryana) they have a refining capacity of 112.54 million tones a year.

These refineries also supply cooking gas or liquefied petroleum gas (LPG) as domestic fuel it has succeeded in reducing demand on our shrinking forests. In recent years, India has become a leading producer, consumer and importer of petroleum products. The transport sector alone uses up 50% of petroleum products and another 16-20% are consumed by industries.

Lifelines of National Economy

TEXTUAL QUESTIONS

Q2. Answer the following questions in about 30 words.

i. State any three merits of roadways.

Ans. India has one of the largest road networks in the world, aggregating to about 54.7 lakh km (2014-15). In India, roadways have preceded the railways in view of the ease with which they can be built and maintained. The growing importance of the roadways is rooted in the following points:

1. Roadways are relatively cheaper and easier both in terms of construction and maintenance. Road transport is economical in transportation of a few persons and relatively smaller amount of goods over short distances. They also provides door-to-door services, thus cost of loading and unloading is much lower.
2. Roads can be built comparatively more easily in dissected and undulating topography. They can negotiate higher gradients of slope and as such can be built over mountains such as Himalayas.
3. Road transport is also used as a feeder to other modes of transport as such they provide a link between railway stations, seaports and airports.

ii. Where and why is rail transport the most convenient means of transportation?

Ans. The distribution pattern of railway network in the country has been largely influenced by physiographic, economic and administrative factors. In the northern plains of India, rail transport is the most convenient mode of transportation. This is because the region has vast area in the form of level land which is good for laying tracks. These areas also have high population density and huge agricultural productivity which make the rail transport a profitable venture. These plain areas provide most favourable and convenient conditions for the growth of railways.

iii. What is the significance of the border roads?

Ans. The roads that are constructed in the border areas or run along the frontiers of a country are called border roads. In India, Border Road Organization (BRO) is the agency which constructs and maintains these roads. These roads have the significance of their own due to the following reasons:

1. The border roads have increased the accessibility of defense personals in the areas of difficult terrain like the northern and north eastern border areas of India.
2. These roads help in enhancing the security of sensitive border areas and strengthen our defense preparedness.
3. These roads maintain the supply-line of the soldiers who serve in the advance posts which are often located in highly inhospitable terrain and climatic conditions.
4. These have helped in the economic development of the areas close to political borders.

iv. What is meant by trade? What is the difference between international and local trade?

Ans. The exchange of goods and services among people, states and countries is referred to as trade. This movement of goods and services results in the economic gain by the parties involved. The trade between two or more countries is called international trade and it may take place through sea, air or land routes. While, the trade carried in cities, towns and villages of the same country is called local trade. Advancement of international trade of a country is an index to its economic prosperity.

Q3. Answer the following questions in about 120 words.

i. Why are the means of transportation and communication called the lifelines of a nation and its economy?

Ans. The means of transport and communication are called the lifelines of a nation and its economy due to the following reasons:

1. They bring the far-flung areas of a country quite closer to each other.
2. The advanced means of transportation and communication help in easier and economic production and distribution of goods and services in a country.

3. They link our country with rest of the world despite its vast size, diversity and linguistic and socio-cultural plurality.
4. The efficient network of transport and communication is pre-requisite for local, national and global trade.
5. Fast developing communication channels and transportation systems which connect different nations of the world have given rise to globalization. Today, India is well linked with the rest of the world and it has been possible only because of the developments in transport and communication systems.
6. Air transport carries a large number of passengers to the longest journeys in lesser possible time with more comfort.
7. The means of transport like trains and ships carry thousands of tones of different commodities from one part of a country or the world to the other part. They reduce the hardships and burden of the people and the nations which are involved in the activities of import and export of goods.
8. Pipelines are used for transporting crude oil and natural gas to refineries and factories.
9. The means of transport and communication help the government to maintain law and order.
10. During the war times, they facilitate the movement of arms, ammunitions and other supplies.
11. The different means of transport and communication have enriched our life with the amenities and facilities to improve our lifestyles.

Thus, it is clear that there are many advantages of transportation and communication. These means help in the development of the country. So, they are rightly called the lifelines of a nation and its economy.

ii. Write a note on the changing nature of the international trade in the last fifteen years.

Ans. There has been a considerable change in the pattern of international trade over last two decades which can be understood from the following statements:

1. Up to the early 2000s trade flows in the international market rose gradually. This was followed by a sharp fall after the economic crisis in 2008. Recent years have witnessed a moderate recovery.
2. International trade experienced fairly strong growth from 2002 to 2008 accompanied by rising commodity prices. Following the financial crisis in 2008, trade fell steeply in 2009 before rebounding strongly in 2010 and 2011. However, trade growth since then has been unusually weak.
3. Various crises had an impact on international trade from 1995 to 2001. These included the Asian financial crisis of 1997 and the bursting of the dotcom bubble in 2001.
4. China's accession to the WTO in December 2001 paved the way for its economic rise and significantly contributed to increasing world trade from 2002 to 2008. Strong Chinese demand for natural resources contributed to rising prices for crude oil and other primary commodities between 2002 and 2008. The 2008 financial crisis led to a global recession between 2008 and 2011. The volume of world exports plunged to 12% in 2009 while world gross domestic product (GDP) dropped by 2%.
5. International trade in commercial services has been less volatile than merchandise trade in the last 15 years. This indicates the greater resilience of services to global macroeconomic upheaval. Over the last two decades, world services trade has recorded negative annual growth only once (-9 per cent in 2009), in the wake of the global financial crisis. In 2010, services trade resumed its pre-crisis level and has continued to expand steadily despite sluggish economic growth.
6. From 2005 to 2020, world exports of computer and information services expanded much more rapidly than any other services sector, recording as much as 18 per cent average annual growth.
7. Emerging economies, particularly in Asia, have become increasingly important exporters of computer services.
8. Information technology was the most resilient services sector during the global economic crisis. This was possible due to constant demand for cost-efficient technologies, the development of innovative software for purposes and the rising need to address IT security concerns.
9. Driven by rapid technological progress, the communications sector has recorded remarkable growth since 2000. It happened because the number of worldwide subscriptions to mobile phones has risen considerably.

10. Communications services coped relatively well with the global economic slowdown due to continuous demand for mobile phone services, especially in developing economies, and a robust demand for Internet services.
11. International trade in financial services has expanded significantly over the last 20 years as financial markets have become increasingly open and globalized. Financial services are the second-most dynamic services sector after computer and information services.
12. New technology, improved Internet access, and electronic pay and delivery systems have created a new means of trade called e-commerce which has helped to reduce trade costs in the international market.
13. India has trade relations with all the major trading blocks and all geographical regions of the world. The commodities exported from India to other countries include agricultural and allied products, base metals, gems and jewellery, chemicals and related products etc. The commodities imported to India include crude petroleum and its products, base metals, electronic items, machinery etc. Since independence, India has improved much in the field of international trade and continuous efforts in this direction have made the international trade favourable to India.
14. The changing nature of the international trade for India, in the last fifteen years, has been impressive. Exchange of information and knowledge has surpassed exchange of goods and commodities in the international market. Through its advanced software knowledge and excellence in the field of information technology, India has emerged as a viable contender at the international level. India is earning huge foreign exchange by sharing its knowledge at the international forum in the field of software development and information technology. Tourism too has added to India's upgraded position in the international trade. Thus, international trade for India has undergone a recognisable change in the past fifteen years.

Q4. Find out the places linked by National Highway 2 and 3.

Ans. National Highway 2 is the part of Golden Quadrilateral Super Highway which links the cities like Aurangabad, Varanasi, Prayagraj (Allahabad), Kanpur, Agra and Delhi.

National Highway 3 links the cities like Mumbai, Nasik, Indore, Biora, Shivpuri and Gwalior.

Q5. Find out the current railway zones of India and their headquarters. Also locate the headquarters of railway zones on the map of India.

Ans. As of August 2020, the Indian railways have been divided into 18 zones in order to manage them properly. These eighteen zones are:

Railway Zones of India	**Headquarters**
1. Central	Mumbai
2. Western	Mumbai
3. Northern	Delhi
4. Eastern	Kolkata
5. Southern	Chennai
6. East Central	Hajipur
7. East Coast	Bhubaneshwar
8. North Central	Allahabad
9. North Eastern	Gorakhpur
10. North East Frontier	Guwahati
11. North Western	Jaipur
12. South Central	Sikanderabad
13. South East Central	Bilaspur
14. South Eastern	Kolkata
15. South Western	Hubli
16. South Coastal	Visakhapatnam
17. West Central	Jabalpur
18. Kolkata Metro	Kolkata

Students are advised to do the corresponding map work to locate the headquarters of railway zones according to the guidelines learnt at school.

Q6. Find out the names of the countries connected by Air India.

Ans. The countries which are connected by Air India include Afghanistan, Australia, Bahrain, Bangladesh, Canada, China, France, Germany, Japan, Kenya, Kuwait, Maldives, Myanmar, Nepal, Nigeria, Oman, Qatar, Saudi Arabia, Singapore, South Korea, Sri Lanka, Thailand, UAE, United Kingdom and United States.

ADDITIONAL QUESTIONS

Q1.Which road was built by Sher Shah Suri? Which two cities it connects?

Ans. Grand Trunk (G.T.) road was built by Sher Shah Suri. It connects Kolkata (India) in the east to Peshawar (now in Pakistan) in the west.

Q2. How many types of roads are there in India? Name them.

Ans. There are the seven types of roads in India namely;
National highways, state highways, district roads, village roads, border roads, international highways and free-ways (express ways).

Q3. What are express ways?

Ans. Express ways are the newly built highways with 4 to 6 lanes which are used for long distances. They have been built in order to curb increasing traffic pressure on highways.

Q4. What does BOT stand for? Define it.

Ans. BOT stands for Build, Operate and Transport. It is a scheme under which express ways are built by private agencies and then operated by them in order to earn their profits and at final stage they are transferred to government.

Q5. Name the places, which are connected by Golden Quadrilateral Super Highways.

Ans. Delhi, Mumbai, Chennai and Kolkata are the important metropolitan cities which are connected by Golden Quadrilateral Super Highways.

Q6. Which is the world’s highest highway?

Ans. Leh- Manali Highway connecting Leh with Himachal Pradesh is the world’s highest highway.

Q7. What is DWT?

Ans. It stands for dry weight tonnage. It means the weight of a newly constructed ship without luggage and passengers.

Q8. Define the term Wagon.

Ans. It is an open or closed vehicle used by railways to transport heavy goods from one place to another.

Q9. Define the term coach.

Ans. A coach is a carriage with a roof and seats used by railways to carry passengers from one place to another.

Subject: Urdu

(فانی بدایونی کی غزل۔ا)

1) شاعر کے نزدیک موت ایک محبوب شئی ہے لھٰذا وہ کہہ رہا ہے میں نہیں جانتا ہوں کہ میری زندگی مہنگی چیز ہے یا سستی، البتہ اگر مجھے موت جیسی محبوب چیز بھی مفت ملے میں لینے کیلئے تیار نہیں ہوں زندگی کی بات ہی نہیں وہ تو میری مبغوض شئی ہے۔

2) شاعر فرماتے ہیں اے میرے محبوب میں نے آباد اور ویران دونوں قسم کی بستیاں دیکھی ہیں۔ ویرانے کبھی آباد بھی ہوجاتے ہیں، لیکن دل وہ انوکھی بستی ہے جو اُجڑنے کے بعد کبھی بھی آباد نہیں ہوجاتی ہے۔ یعنی جب ایک بار کسی کی محبت دل میں بس جاتی ہے تو پھر جُدا نہیں ہوسکتی ہے۔

3) شاعر فرماتے ہیں میں اپنے محبوب کی ایک نظر کے بدلے اپنی جان تک قربان کرنے کیلئے تیار ہوں۔ البتہ آگے میرے محبوب کی مرضی ہے کہ وہ اس دام پر راضی ہے یا نہیں۔ اگر وہ راضی ہوگا تو میں اس سودا کو سستا سمجھوں گا۔

4) اے میرے محبوب مجھے یہ دنیا تمہارے بغیر اُداس اور اُجڑی معلوم ہوتی ہے۔ میری آنکھیں تمہارے دیدار کو ترستی ہیں۔ حالانکہ یہ دنیا پہلے بھی آباد تھی اب بھی آباد ہے لیکن مجھے تمہاری جُدائی کی وجہ سے اُجڑی دکھائی دیتی ہے۔

5) شاعر فرماتے ہیں اے میرے محبوب میں نے آپکی جُدائی میں اتنے آنسو بہائے ہیں کہ اب میری آنکھیں خشک ہوگئی ہیں اور دل پر غموں کے بادل چھائے ہوئے ہیں جو نہ کھلتے ہیں اور نہ ہی جم کر برستے ہیں۔

6) اے میرے ظالم محبوب کسی کے دل میں بس کر اسکو اُجاڑنا آسان کام ہے، لیکن کسی کے دِل کو آباد رکھنا یعنی محبت کو نبھانا بہت ہی مشکل کام ہے۔ جس طرح دنیا کی بستی آہستہ آہستہ آباد ہوجاتی ہے اسی طرح محبت آہستہ آہستہ دل میں اپنا رنگ جماتی ہے۔

7) غزل کے مقطع میں فانی بدایونی فرماتے ہیں کہ محبوب کی جدائی میں میری آنکھوں میں اتنے آنسو بہائے کہ یہ آنسو بہاتے بہاتے خشک ہوگئی ہیں اور اب یہ دو بوندوں کے لیے بھی ترستی ہیں۔ یہ ساری صورت حال محبوب کی جُدائی کی وجہ سے پیدا ہوگئی ہے۔

8) سوال ا۔ شاعر (فانی بدایونی) کس کی نظر کے بدلے میں اپنی جان جیسی قیمتی چیز دینا چاہتا ہے؟

9) جواب۔ شاعر محبوب کی نظر کے بدلے میں اپنی جان جیسی قیمتی چیز دینا چاہتا ہے۔

10) سوال ۲۔ فانی بدایونی کی غزل کے دوسرے شعر میں دل کی بستی کو "ترالی بستی" کیوں کہا گیا ہے؟

11) جواب۔ فانی بدایونی کی غزل کے دوسرے شعر میں دل کی بستی "نرالی بستی" اس لیے کہا گیا ہے کیونکہ اگر بستیاں اُجڑ جاتی ہیں تو دوبارہ تعمیر کی جاسکتی ہیں لیکن دل اگر ایک بار اُجڑ جائے تو دوبارہ آباد نہیں ہو سکتا۔

(عرش صہبائی کی غزل نمبر۱)

1) شاعر صاحب فرماتے ہیں میں نے زندگی میں اسقدر ' مصائب اور تکالیف اُٹھائے ہیں جنکا شمار مشکل ہے اور بے شمار زخمیں کھائی ہیں جو میرے دل میں تازہ ہیں اور مجھے ستارہے ہیں۔

2) شاعر فرماتے ہیں میں ہمیشہ اپنے وجود میں گم رہا' اور اسکے خول میں قید رہا' کیونکہ چاروں طرف کا ماحول ناپاک اور ناپسندیدہ تھا' مغربی تہذیب کے رنگ میں رنگا ہوا تھا۔ میں اس تہذیب سے کچھ متاثر نہ ہوا بلکہ اپنی تہذیب کی پاکیزہ قدروں پر کار بند رہا۔ حصار ذات سے شاعر کی مراد اپنی ذات ہے اور دیواروں سے مُراد مغربی تہذیب ہے۔

3) میرے محبوب کی آنکھوں میں محبت کے جذبات چمک اور تابانی تھی۔ اس پر مغربی تہذیب کا کوئی اثر نہ تھا' شاعر کا محبوب اپنی پاکیزہ تہذیب ہے۔

4) شاعر اپنے کو مخاطب کر کے کہتے ہیں اے عرش ' میرے محبوب کی گہری آنکھوں کا کوئی قصور نہیں ہے بلکہ ڈوبنے والوں کا قصور ہے جنکو اسکی گہرائی کا اندازہ نہیں تھا اور ان میں کود کر مٹ گئے۔

(عرش صہبائی کی غزل نمبر۲)

1) شاعر اپنے محبوب سے کہہ رہا ہے کہ میری تقدیر میں صرف غم اور پریشانیاں ہیں۔ زندگی کے ہر موڑ پر مجھے غموں اور تکلیفوں سے سابقہ پڑا۔ میں اپنی زندگی کو کسی مفلس یا مظلوم کی بددعا کا نتیجہ سمجھتا ہوں۔ کیونکہ مظلوم کی دُعا فورًا قبول ہو جاتی ہے۔

2) اے میرے محبوب! تو آج میرا خدا بن بیٹھا ہے' اسی لئے مجھے ستارہا ہے اور اپنی نگاہ کرم سے نہیں نوازتا ہے۔ حالانکہ معلوم ہونا چاہیئے کہ میں نے ہی دل دیکر تمہیں اپنا محبوب بنایا' اگر میں نے تمہیں نہ چاہا ہوتا تو میرا محبوب نہ ہوتا۔

3) اے میرے محبوب ! میں تو تمہاری ایک ہی نظر سے خوش ہو جاتا ' اگرچہ وہ بے رُخی ہی کے ساتھ کیوں نہ ہوتی۔ میں تمہاری ترش نگاہ کو بھی باعث فخر اور باعث مسّرت سمجھتا ہوں۔

4) عرش اپنے سے مخاطب ہو کر کہتا ہے ' اے عرش ! میرا محبوب اور اسکی محبت میرے دل و جان اور رگ وپے میں سرایت کر چکی ہے ' اگرچہ میرا محبوب بظاہر میرے جسم سے جُدا ہی کیوں نہ ہے۔

سوال ا۔ شاعر (عرش صہبائی) نے حصار ذات سے نکل نہ سکنے کی کیا وجہ بتائی؟

جواب۔ شاعر (عرش صہبائی) نے حصار ذات سے نکل نہ سکنے کی یہ وجہ بتائی ہے کہ اس کی زندگی میں صرف غموں کی دیواریں ہی دیواریں تھیں جہاں سے نکلنے کا
کوئی دروازہ نہ تھا۔

اکبر جے پوری غزل نمبر۔ا

1) مطلع میں اکبر جے پوری فرماتے ہیں کہ نہ جانے کیسے کیسے منظر مٹی میں مل گئے اور سکندر جیسے کتنے عظیم بادشاہ خاک کی نذر ہو گئے۔

2) اس شعر میں شاعر فرماتے ہیں کہ دنیا میں بہت سے لوگ ایسے ہیں جنکے ہونٹوں کی پیاس ان کی آنکھوں سے چھلکتی ہے وہیں کچھ لوگ ایسے بھی ہیں جن کے محلوں میں شراب کی ندیاں بہتی ہیں۔

3) اس شعر میں اکبر جے پوری فرماتے ہیں کہ کچھ لوگ ایسے بھی ہیں جو امن کا علمبردار بن کر شہروں شہروں گھومتے ہیں جبکہ یہی وہ لوگ ہیں جو اپنی آستینوں میں خنجر چھپائے ہوئے ہیں۔ اور قوم کے قاتل ہیں۔

4) شاعر فرماتے ہیں کہ اگرچہ بستی میں فریادی کو بہت سے دروازے کھلے ملے لیکن اُسے وہاں سے ملنے کی کوئی امید نہیں تھی اگر مجھے وہ بلاتا بھی تو کیسے ؟ کیونکہ بد قسمتی سے اُسے میرا پتہ معلوم نہ تھا۔

5) شاعر فرماتے ہیں کہ میری فاقہ کشی اور تشنہ لبی پر تعجب مت کرو کیونکہ میں نے بہت سے پیاسوں کی پیاس بجھائی ہے اور لوگوں کا فقر و فاقہ دور کیا ہے اسلیے میں اس حال تک پہونچ چکا ہوں۔

سوال۔ امن کا پرچار کرنے والوں کی آستینوں میں کیا چھپا ہوا ہے ؟

جواب۔ امن کا پرچار کرنے والوں کی آستینوں میں خنجر چھپا ہوا ہے۔

ہمدم کاشمیری غزل نمبر۔۱

1 . مطلع میں ہمدم کاشمیری فرماتے ہیں کی ایسا ہرگز نہیں ہے کہ میں ہمیشہ مفلس و تنگ دست اور بے سروسامان تھا بلکہ میں بھی کبھی صاحب مکان تھا اور میری بھی شان و شوکت تھی۔

2 . اس شعر میں شاعر فرماتے ہیں کہ کسی کو اس بات کا یقین نہ تھا کہ اس شہر میں ظالموں کی حکومت ہو گی اور کسی کی فریاد نہیں سنی جائے گی جبکہ آج حقیقت یہی ہے۔

3 . شاعر اس شعر میں فرماتے ہیں کہ ہماری سر زمین پر اسقدر بے گناہوں اور معصوم انسانوں کا خون بہایا گیا کہ تیز بارش اور موسلادھار برسات میں بھی اسکا نشان ختم نہ ہو سکا۔

4 . مقطع میں ہمدؔم اپنے بارے فرماتے ہیں کہ کبھی ایسا بھی وقت تھا کہ اس خاموش شہر میں صرف ہمدؔم کی آواز گونجتی تھی اور صرف وہی حق گوئی اور بیباکی کا پیکر تھا اب ایک عرصہ گذر گیا مگر ہمدؔم خاموشی کا مجسّمہ بنا ہوا ہے۔

غزل نمبر۲

1 . مطلع میں ہمدؔم فرماتے ہیں کہ ایک وقت وہ بھی تھا جب میرے دل میں خوشی و مسرت کا کوئی موسم نہ تھا اور آنکھیں بھی حسین مناظر کے لیے ترس گئی تھیں۔

2 . اس شعر میں ہمدؔم فرماتے ہیں کہ میرے اوپر لوگ ہر طرف سے حملہ آور ہو رہے تھے اور مجھے تکلیف پہونچانے کے درپے تھے مگر افسوس ! میرے ہاتھ میں کوئی پتھر نہ تھا جس سے میں اپنا دفاع کر سکتا۔

3 . شاعر اس شعر میں فرماتے ہیں کہ میں نے محبوب سے ملنے کا جو خواب دیکھا تھا شاید وہ حقیقت بن گیا ہے کیونکہ اگر میرے محبوب کا پیکر اور وجود نہ تھا تو آخر یہ لَمس (چھونے) کا احساس کیسا تھا

4 . شاعر فرماتے ہیں کہ شاید ہمارے شہر پر کسی جادو کا سایہ پڑ گیا ہے کیونکہ جب مسرت بھرا چاند نکلا تو اسکی خوبصورتی دیکھنے کے لیے کوئی چھت پر نہ آیا۔

5. شاعر مقطع میں فرماتے ہیں کہ محبوب کی محبت بھری آواز برسوں تک میرے گھر میں گونجتی رہی ۔واقعی یہ محبوب کی آواز ہی تھی کیونکہ جب میں نے دروازے پر دیکھا تو وہاں کوئی نہ تھا۔

سوال ا۔ پہلے غزل کا دوسرا شعر پڑھ کر بتلایئے کہ شاعر کو کس چیز کا گمان نہیں تھا۔

جواب۔ شاعر کو اس چیز کا گمان نہ تھا کہ حالات اس قدر بگڑ جائیں گے کہ ہر طرح اندھیرا ہی اندھیرا چھائے گا ہر طرف بدامنی ہو گی اور انصاف کا نام ونشان مٹ جائے گا۔

شبیب رضوی کی غزل نمبرا

1) اے میرے محبوب اگرچہ آپ نے محبت کی کتاب بند کر دی ہے تو کم از کم سلام وکلام نہ چھوڑنا تاکہ مجھے تسّلی ملے اور اطمینان حاصل ہو۔

2) محبوب کے فراق اور جدائی کے غم میں شاعر پریشان ہو کر گھر سے رات کی تنہائی میں سکون کی تلاش میں نکلتا ہے ،لیکن گھر والوں سے کہہ کے جاتا ہے کہ دروازہ کھلا رکھنا ہو سکتا ہے میں رات کی خاموشی سے بھی تنگ آ کر واپس لوٹ آوں۔

3) اس شعر میں صنعت تلمیح ہے۔ جب حضرت زینبؓ کو یزید نے گرفتار کروایا تو انکو سر کھلا رکھنے پر مجبور کیا ، حضرت زینبؓ رحم کی مستحق تھی لیکن اسکے برعکس یزید نے انکے ساتھ سختی کا معاملہ کیا۔ گویا شاعر اپنے محبوب سے کہتا ہے کہ میں تمہارے نظر کرم کا مستحق تھا لیکن تو یزید کی طرح ضدی اور بے رحم ہے۔

4) شاعر زندگی کے میدان میں کودنے والوں کو جرات اور ہمت دلاتے ہوئے کہتا ہے کہ مصائب اور آلام کا مقابلہ ڈٹ کر کرنا چاہیے۔ ہمت نہیں ہارنی چاہیے ،کیونکہ جو شخص ہمت ہارے گا مٹ جائے گا۔ بہادر وہ ہے جو جم کر طوفان کا مقابلہ کرے۔

۵۔ غزل کے مقطع میں شبیب رضوی انسان کے فراخدل ہونے کی وکالت کرتے ہوئے فرماتے ہیں کہ ہر شخص کو اُس کا وہ ہُنر جو اُس کے پاس ہے دوسروں تک پہنچانا چاہیے۔ اُسے وہ ہُنر دوسروں کو سکھانے میں بخل نہیں

کرنا چاہیے۔ یہ اور بات ہے کہ پھر کوئی سیکھے یا نہ سیکھیے۔ لیکن ہمارے لیے یہ ضروری ہے کہ ہم اپنا دست ہُنر ہمیشہ کھلا رکھیں یعنی دوسروں کو سکھائیں۔

غزل (۲)

ا۔ غزل کے مطلع میں شاعر شبیب رضوی نے موجودہ دور کی زندگی کو اذیت ناک اور تکلیف دہ قرار دیتے ہوئے فرمایا ہے کہ میری زندگی میں ہر چیز کی کمی ہے میری زندگی ایسی بھوکی اور پیاسی ہے جیسے میدان کربلا میں امام حسین اور اُس کے ساتھیوں کی زندگی تھی یعنی وہ زندگی جو ہر چیز سے محروم تھی۔

۲۔ شاعر شیب رضوی نے اس شعر میں واقعہ کربلا کے اُس سین کی منظر کشی کی ہے جب وہاں اُداسی چھائی ہوئی تھی اور ہر ایک خیمہ ویرانی کا منظر پیش کررہاتھا۔ شاعر فرماتے ہیں کہ کربلا میں جب امام حسین کے سارے ساتھی، اولاد اور شتے دار شہید ہوگئے تو ایسے حالات میں پورے کربلا میں اُداسی اور ماتم چھا گیا۔

۳۔ شبیب رضوی اس شعر میں حضرت الی کے قول کے تناظر میں فرماتے ہیں کہ ہر ایک شخص کو اپنی اصلاح کرنی چاہیے اور جس کسی نے بھی اپنے آپ کو پہچان لیا اس نے دراصل خدا کو پہچان لیا۔

۴۔ شبیب رضوی اس شعر میں شندگی کی حقیقت سے پردہ ہٹانے کی بھرپور کوشش کرتے ہوئے فرماتے ہیں کہ زندگی یوں تو ہمیں معمولی سی معلوم پڑتی ہے لیکن اگر انسان اس زندگی کو بامقصد طریوے پر گزاردے تو اسے زندگی کے ہر موڑ پر کامیابی سے ہمکنار کرسکتی ہے اس طرح زندگی ایک بڑی کتاب سی مانند ہے۔

۵۔ غزل کے مقطع میں شبیب رضوی نے موجودہ دور کے انسان کی لالچ اور بے شمار خواہشات کی طرف اشارہ کرتے ہوئے فرمایا ہے کہ انسان تمناوں کے جال میں پھنس کے رہ گیا ہے اور اس کی ساری تمنائیں پوری نہیں ہوتیں۔ انسان کو تسکین ہی نہیں مل رہی ہے اور اگر یہی حالت رہی تو ڈر ہے کہ زندگی اپنا وجود ہی ختم نہ کردے۔

سوال ا۔ شبیب رضوی کی شامل نصاب غزلوں میں ایسے تین شعر لکھیے جن میں واقعہ کربلا کی طرف اشارہ کیا گیا ہو۔

جواب۔ ہماری شرط کہ ہم پر ہو سایہ رحمت　　　تمہاری ضد ہے کہ کوفے میں سر کھلا رکھنا

کتنی بھوکی ہے کتنی پیاسی ہے　　　زندگی دشت کربلا سی ہے

سب گئے شمع دل جلائے ہوئے   خیمہ خیمہ بہت اُداسی ہے

سوال ۲۔ پہلی غزل کے دوسرے شعر میں کیوں بچوں کو گھر کا دروازہ کُھلا رکھنے کے لیے کہا گیا؟

جواب۔ پہلی غزل کے دوسرے شعر میں بچوں کو گھر کا دروازہ کھلا رکھنے کو اس لئے کہا گیا کہیں شاعر تنہائی اور خاموشی سے تنگ نہ آئے۔

سوال ۳۔ پہلی غزل کے تیسرے شعر میں شاعر نے جس واقعہ کی طرف اشارہ کیا ہے اسے مختصر طور بیان کیجیے۔

جواب۔ اس شعر میں شاعر شبیب رضوی واقعہ کربلا کی جانب اشارہ کرتے ہوئے فرماتے ہیں کہ کربلا میں حضرت زینبؑ اپنے بھائی امام حسینؑ کے پاس ننگے سر اور برہنہ پاوں دوڑ کے جاتی ہے اور کہتی ہے کہ بھائی جان دیر نہ کرو اللہ کے راستے میں لڑنے کے لیے تیار ہو جاؤ۔ اس پر امام حسینؑ جواب دیتے ہوئے فرماتے ہیں کہ یہیں ہم پر خدا کا سایہ ہو اور خدا کی رحمت نازل ہو تمہیں دوڑ کر آنے کی ضرورت کیونکر محسوس ہوئی۔

قصیدہ

قصیدہ کا لفظی معنی قصد وارادہ ہے اس قسم کی نظم کو قصیدے کا نام اس لیے دیا گیا ہے کیونکہ شاعر قصد وارادہ اور انتہائی جدو جہد کے ساتھ اس قسم کی شاعری کرتا ہے۔ اصطلاح شعراء میں قصیدہ اس نظم کو کہتے ہیں جس میں کسی کی مدح (تعریف) یا مذمت (برائی) بیان کی جائے۔

قصیدہ کی قسمیں۔

ا۔ قصیدہ کی دو قسمیں ہیں۔   قصیدہ تمہیدیہ   قصیدہ خطابیہ

قصیدہ تمہیدیہ :۔ وہ قصیدہ ہے جس کی ابتدا تمہید سے ہو۔

قصیدہ تمہیدیہ کے چار حصہ ہیں

ا۔ تمہید یا تشبیب :۔ اس حصہ میں شاعر تمہید کے طور پر کچھ باتیں کہتا ہے۔

۲۔ گریز :۔ اس حصہ میں شاعر تمہید کو چھوڑ کر اصل موضوع کی طرف آتا ہے۔

۳۔ مدح یا مذمت :۔ یہ قصیدہ کا اصل موضوع ہوتا ہے۔ اس میں شاعر اچھائی یا برائی بیان کرتا ہے۔

۴۔ مقطع یا خاتمہ بر دُعا :۔اس میں شاعر ممدوح کی سلامتی اور اپنا مقصد بیان کرتا ہے۔

قصیدہ خطابیہ :۔وہ قصیدہ ہے جس کی ابتدا بلاواسطہ تعریف یا مذمت سے ہو۔

اکثر شعراء نے اس صنف میں طبع آزمائی کی ہے۔اس صنف میں سودا' دبیر اور کچھ غزل گو شعراء کے نام قابل ذکر ہیں۔

قصیدہ شہر آشوب

یہ قصیدہ شہر آشوب مرزا محمد رفیع سوداؔ نے نظم کیا ہے۔ شروع شروع میں شہر آشوب کی اصطلاح ان نظموں کیلیئے استعمال ہوتی تھی جن میں رنجیدگی' ماتم' طنز اور غصّے وغیرہ کا بیان ہوا کرتا تھا۔ لیکن آجکل ان نظموں کیلیئے استعمال ہوتی ہے جن میں کسی شہر کی تباہی اور بدحالی یا زمانے کی ابتری اور بد نظمی کا ذکر ہو۔اسی لئے ان تمام نظموں کو شہر آشوب نام دیا گیا جو ۱۸۵۷ء میں دلّی کی تباہی اور رنج و غم کے بارے میں لکھی گئیں۔اس رسم کو نبھاتے ہوئے سودا نے پیشوں کے ذکر کے ساتھ شہر کی بدحالی کا تذکرہ کیا۔

شاعر محترم نے پہلے تین اشعار میں تعلّی سے کام لیتے ہوئے اپنی فصاحت اور بلاغت اور انداز بیان کی خوب تعریف کی ہے۔اس کے بعد دلائل سے ثابت کیا ہے کہ تمام انسانوں کی پریشانی کی بنیادی اور حقیقی وجہ اقتصادی بحران یعنی وجہ معاش ہے۔شاعر نے اس نظم میں بڑے ملازم' تاجر' مُلا اور شیخ جی کی پریشانی اور بے اطمینانی کو ظاہر کیا ہے۔

ایسے ملازم بظاہر خوشحال دکھائی دیتے ہیں جنکو حکومت کی طرف سے گھوڑا گاڑی کا انتظام ہوتا ہے' لیکن جب نزدیک سے دیکھا جاتا ہے تو معلوم ہوتا ہے کہ بیچارے اپنی چیزیں گروی رکھ کر گھر کی ضروریات پوری کرتے ہیں۔ سوداگر کو دیکھیے کہ بڑی مشقت کے ساتھ اپنا مالِ تجارت ایک شہر سے دوسرے شہر یا ایک ملک سے دوسرے ملک لے جاتا ہے تب جا کر اپنی مجبوری کو پورا کرتا ہے۔

رہے شعرا انھیں عید کے دن بھی کسی مالدار کے ہاں نظمِ مبارک بادی سنانے کی فکر رہتی ہے۔مُلا حضرات تو دنیا کی حقیر دولت کے بدلے دوسروں کی ثناخوانی کرتے پھرتے ہیں۔استاد کی تنخواہ اتنی قلیل ہوتی ہے کہ

ہمیشہ دال روٹی پر گذارہ کرنا پڑتا ہے۔رہے عابدوزاہد تو جب کبھی کسی میلے پر اپنے مریدوں کی جماعت لیکر بڑی آن بان کے ساتھ جاتے ہیں اور ڈھولک بجنے سے لوگ وجد میں آتے ہیں تو شیخ مست ہو کر بے تال ہو جاتے ہیں' اور ساری محفل کے طنز و مزاح کا نشانہ بن جاتے ہیں۔ مختصر سودآ یہ فرماتے ہیں کہ خوشحالی محض ایک ڈھونگ ہے جو نہ دنیا میں ہے اور نہ ہی جنتّ میں ہو گی۔

سوال ا۔آپ کی نصابی کتاب میں درج قصیدہ کس شاعر کا ہے اور اس کا عنوان کیا ہے؟

جواب۔ نصابی کتاب میں درج قصیدہ مرزا سودا لکھا ہوا ہے اور اس کا عنوان قصیدہ شہر آشوب ہے۔

سوال ۲۔ قصیدے کا آغاز کس ملک سے ہوا؟

جواب۔ قصیدے کا آغاز ملک عرب سے ہوا۔

سوال ۳۔ کس شاعر کو اردو قصیدے کا امام کہا جاتا ہے؟

جواب۔ مرزا محمد رفیع سودا کو اردو قصیدے کا امام کہا جاتا ہے۔

سوال ۴۔ سودا نے قصیدہ شہر آشوب میں جن پیشوں کا ذکر کیا ہے ان کی فہرست بنایئے؟

جواب۔ سودا نے قصیدہ شہر آوب میں جن پیشوں کا ذکر کیا ہے ان کی فہرست درج ذیل ہے۔

ا۔سپاہی	۲۔سوداگر	۳۔استاد	۴۔مُلا
۵۔شاعر	۶۔نوکر	۷۔بَنیا	۸۔مُدرّس
۹۔مُعلّم	۱۰۔شیخ		

سوال۶۔ شہر آشوب سے کیا مُراد ہے؟

جواب۔ شہر آشوب ایک ایسی نظم کو کہتے ہیں جس میں کسی شہر کی تباہی اور بدحالی یا زمانے کی عام ابتری اور بد نظمی کا ذکر ہو۔

سوال ۷۔ اس قصیدے کو شہر آشوب کیوں قرار دیا ہے؟

جواب۔ اس ُ قصیدے کو شہر آشوب اس لیے قرار دیا ہے کیونکہ اس میں دہلی شہر کے اُجڑ جانے وہاں مختلف پیشوں سے وابسطہ افراد کے مصائب اور رنج و غم کا ذکر کیا گیا ہے۔

نعت

نعت کے لغوی معنی مدح، ثنا اور تعریف کے ہیں۔ اصطلاح میں نعت اُس صنف شعر کو کہتے ہیں جس میں پیغمبر اسلام حضرت محمد ﷺ کی مقدس سیرت اور صورت کے کسی بھی پہلو کی مدح کی جائے اس میں ہیت کی کوئی قید نہیں ہے اس لیے نعت موضوعی صنف ہے۔

نعت گوئی کا باعدہ آغاز دور رسالت میں ہی ہوا۔ دربانبوی ﷺ کے شاعر حضرت حسان بن ثابتؓ نے حضور ﷺ کے روبرو بارہا نعتہ اور مدحیہ اشعار پیش کر کے دادو تحسین حاصل کی۔

عربی زبان کے نعت گو شعرا میں حسان بن ثابتؓ اور کعب بن زہیرؓ سر فہرست ہیں۔ عربی کے بعد فارسی زبان میں بھی نعت گوئی شروع ہوئی اور بڑے بڑے نعت گو پیدا ہوئے۔ مثنوی نگاروں نے مثنویوں میں باقاعدہ طور حمد کے بعد نعت لکھنے کو رواج دیاہ۔ فارسی نعت گو شعرا میں شیخ سعدی شیرازی' نظام گنجویاور عبد الرحمان جامی مشہور ہیں۔ برصغیر کے نعت گو شعرا میں امیر خسرو کا مقام اہم ہے۔

اردو میں نعت اعربی اور فارسی سے آئی۔ اُردو کے اکثر شعرا نے نعتیں لکھی ہیں جن میں بہت سے غیر مُسلم بھی شامل ہیں۔ میر تقی میر، مولانا شبلی، ڈاکٹر اقبال، احمد یار خان اور رضا بریلوی کے علاوہ بہت سے شعرا کی نعتیں کافی مقبول ہیں۔

سوال ۱۔ حضرت محمد ﷺ کیا پیغام لے کر آئے؟

جواب۔ حضرت محمد ﷺ امن آشتی اور رواداری کا پیغام لے کر آئے۔

سوال ۲۔ شاعر نے کیوں کہا ہے؟

تو وہ سرد قامت نہیں جس کا سایہ   مگر بن کے رحمت تو عالم پر چھایا

جواب۔ روایت کے مطابق حضور ﷺ کے جسم کا سایہ نہیں ہوتا تھا۔ لیکن خود حضرت محمد ﷺ تمام دُنیا کے لوگوں کے لیے رحمت کا سایہ بن کر رہے۔

سوال ۴۔ رسا جاودانی کی نعت کا خلاصہ اپنے الفاظ میں لکھیے۔

جواب۔ یہ نعت شاعر کشمیر عبدالقدوس رسا جاودانی کی لکھی ہوئی ہے۔ اس نظم میں رسؔا جاودانی حضور اکرمؐ کی مدح سرائی کرتے ہوئے فرماتے ہیں ۔آپؐ عالم انسانیت کے غم خوار خالقِ کائنات کی تمام تخلیقات کے شاہکار بنکر تشریف لائے۔ آپؐ تمام انبیاء کے سردار ہیں آپؐ خوبصورتی اور خوب سیرتی دونوں کے مجموعہ ہیں عالم انسان کی تمام نگاہیں آپ کے درودِ مسعود کی منتظر تھیں آپ کی تشریف آوری نے لوگوں کو انسانیت کا درس دیا۔ اور آپؐ نے رحمت عالم کا لقب پایا۔ آپؐ نے اللہ کا عطا کردہ قرآن لوگوں کو پیش کیا جو قیامت تک کے لیے دستور عمل ہے۔ آپؐ نے اپنے پرائے ہر ایک پر رحمت کی نگاہ ڈالی۔ یہاں تک اپنے دشمنوں پر بھی رحم و کرم کی چادر ڈالی کیونکہ آپ کے دل میں کسی کے لیے کدورت نہ تھی۔ یہی وہ ادائیں تھیں جو اللہ کو پسند آئیں اور آپ کو اپنا محبوب بنایا۔

مرثیہ

مرثیہ سے مراد ایسی نظم ہے جس میں میں مرنے والے کے اوصاف بیان کر کے اس کی موت پر رنج و غم کا اظہار کیا جائے۔ عام طور پر مرثیے حضرت امام حسینؑ اور دیگر شہدائے کربلا کی شہادت سے متعلق لکھے گئے ہیں۔ دوسرے لوگوں کی موت پر کہی جانے والی نظموں کو شخصی مرثیے کا نام دیا جاتاہے۔ مرثیہ کی کوئی شکل متعین نہیں ہے۔ مرثیے تین مصرعوں، چار مصرعوں، پانچ مصرعوں اور چھ مصرعوں کے بندوں کی شکل میں بھی نظم کیے گئے ہیں۔ اشعار کی تعداد بھی مقرر نہیں ہے۔ تاہم شہدائے کربلا کے ماتم میں جو مرثیے لکھے جاتے ہیں ان میں چند اجزائے ترکیبی کا خیال رکھا جاتا ہے۔ مثلاً

ا۔ چہرہ :۔ چہرہ مرثیے کی تمہید کو کہتے ہیں

۲۔ سراپا :۔ اس حصے میں مرثیے کے ہیرو کے اوصاف بیان کیے جاتے ہیں

۳۔رخصت :۔اس حصے میں ہیرو کو میدانِ جنگ میں جانے کے لیے حضرت امام حسین اور عزیز و اقارب سے رخصت لیتے ہوئے دکھایا جاتا ہے

۴۔آمد :۔میدانِ جنگ کی منظر کشی ،گھوڑے اور ہتھیاروں کی مبالغہ آمیز تعریفیں

۵۔رجز :۔ہیرو کے خاندان کی بہادری اور مہارت بیان کی جاتی ہے

۶۔جنگ :۔اصلی جنگ کی منظر کشی کی جاتی ہے

۷۔شہادت :۔ہیرو کے شہید ہونے کا بیان

۸۔بین :۔اس آخری حصے میں شہید کی خوبیاں مؤثر انداز میں بیان کی جاتی ہیں۔ماتم اور آہ وزاری کا بیان ہوتا ہے

میر ببر علی انیس اور مرزا سلامت علی دبیر اردو کے مشہور و مقبول مرثیہ گو گزرے ہیں۔انہوں نے مرثیہ کے اجزائے ترکیبی کا پورا خیال رکھا ہے تاہم یہ ضروری نہیں کہ ہر ایک مرثیے میں ان اجزائے ترکیبی کا التزام ہو۔

سوال ا۔حضرت امام حسین نے یزیدی فوج سے کیا سوال کیا؟

جواب۔حضرت امام حسین نے یزیدیوں سے سوال کیا کہ اس کے چھ مہینے کے معصوم بیٹے حضرت علی اصغر کے لیے پانی دیں۔

سوال ۲۔اس نظم کا خلاصہ لکھیے

جواب۔ یہ مرثیہ مرزا سلامت علی دبیر نے لکھا ہے۔ دبیر اس مرثیے میں کربلا کا وہ واقعہ پیش کرتے ہیں جب حضرت امام حسینؓ اپنے چھ مہینے کے معصوم بیٹے علی اصغرؓ کے لیے یزیدیوں سے پانی دینے کی درخواست کرتے ہیں۔ حضرت امام حسینؓ یہ سوچتے ہوئے یزیدی فوج کے قریب پہنچتے ہیں کہ دشمن میری یہ درخواست نہیں مانیں گے۔ لیکن بچے کی شدت پیاس لیکن غیرت کے مارے اپنی آنکھوں کو نیچے جھکا کر ان سے بولتے ہیں کہ یہ بچے ہم کو آپ کے سامنے لایا ہے اور ان کو اس بات کا خیال دلاتے ہیں کہ یہ بچے کون ہے؟ یہ نجف کا موتی ہے اور شہر بانو کا لال ہے۔ تم مان لو تمہیں اللہ تعالیٰ کی قسم ہے یہ مدینے کے شہزادے کو تم سے پہلا سوال ہے کہ اس بچے کو پانی دو۔ یہ حضرت علیؓ کا پوتا تم سے پانی مانگتا ہے اس کو پانی دے دو کہ اس میں تمہاری ناموری اور ثواب ہے۔ لیکن ظالم پانی

دینے سے انکار کرتے ہیں۔ تب جب حضرت امام حسینؓ اس کے سوکھے لبوں پر زبان پھیرتے ہیں تو تھرا کے آسماں کے طرف دیکھتے ہیں جہاں اس کی روح کوچ کرچکی ہوتی۔

سوال ۵۔ مسدّس کی تعریف لکھیے۔

جواب۔ مسدّس نظم کی وہ ہیت ہے جس میں نظم کا ہر بند چھ مصرعوں کا ہوتا ہے۔ جن میں پہلے چار مصرعے ہم قافیہ اور ہم رویف ہوتے ہیں جبکہ آخری دو مصرعے الگ قافیہ ردیف میں ہوتے ہیں۔ اس ہیئت کو عام طور پر مرثیہ کے لیے برتا گیا ہے۔

